PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM-636 011

DEGREE OF BACHOLAR OF MATHEMATICS

CHOICE BASED CREDIT SYSTEM

Syllabus for

B.Sc., MATHEMATICS

(SEMESTER PATTERN)

(For Candidates Admitted in the Colleges Affiliated to Periyar University from 2023-2024 onwards)

NEW INITIATIVE IN MODERNISING

UNDER-GRADUATE PROGRAMME IN MATHEMATICS

CONTENTS

1. Introduction

B.Sc. Mathematics: Programme Outcome, Programme Specific Outcome and Course Outcome

Mathematics is the study of quantity, structure, space and change, focusing on problem solving, with wider scope of application in science, engineering, technology, social sciences etc. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics. The Bachelor‘s Degree B.Sc. Mathematics is awarded to the students on the basis of knowledge, understanding, skills, attitudes, values and academic achievements expected to be acquired by learners at the end of the Programme. Learning outcomes of Mathematics are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for gaining knowledge of Mathematics.

Bachelor‘s degree in Mathematics is the culmination of in-depth knowledge of algebra, calculus, geometry, differential equations and several other branches of Mathematics. This also leads to study of related areas like Computer science, Financial Mathematics, Statistics and many more. Thus, this programme helps learners in building a solid foundation for higher studies in Mathematics. The skills and knowledge gained have intrinsic aesthetics leading to proficiency in analytical reasoning. This can be utilised in Mathematical modelling and solving real life problems.

Students completing this programme will be able to present Mathematics clearly and precisely, make abstract ideas precise by formulating them in the language of Mathematics, describe Mathematical ideas from multiple perspectives and explain fundamental concepts of Mathematics to non-Mathematicians.

Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

Under Graduate Programme

Programme Outcomes:

PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.

PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one‘s earning to real life situations.

PO4: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.

PO5: Scientific Reasoning: Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.

PO6: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including ‒learning how to learn‖, through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

B. Sc Mathematics

Programme Specific Outcomes:

PSO1: Acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.

PSO2: Understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.

PSO3: To prepare the students who will demonstrate respectful engagement with other‘s ideas, behaviors, beliefs and apply diverse frames of references to decisions and actions. To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)can be carried out accordingly, assigning the appropriate level in the grids:

	POs							PSOs		
	1	2	3	4	5	6	…	1	2	…
CLO1										
CLO2										
CLO3										
CLO4										
CLO5										

2. Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the _Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second-year vacation will help the students gain valuable work experience that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

3. Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Mathematics and simulating mathematical concepts to real world.	• Instil confidence among students • Create interest for the subject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects
		• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.
		• Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment
		• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools
III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong mathematical background • Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of mathematical models in the respective sectors

IV	Industrial Statistics	• Exposure to industry moulds students into solution providers • Generates Industry ready graduates • Employment opportunities enhanced
II year Vacation activity	Internship / Industrial Training	• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V Semester	Project with Viva – voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	• Curriculum design accommodates all category of learners; ‗Mathematics for Advanced Explain' component will comprise of advanced topics in Mathematics and allied fields, for those in the peer group / aspiring researchers; • ‗Training for Competitive Examinations' –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.
Extra Credits: **For Advanced Learners / Honours degree**		• To cater to the needs of peer learners / research aspirants

Skills acquired from the Courses	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

4. Credit Distribution for UG Programme in Mathematics

Sem I	Credit	Sem II	Credit	Sem III	Credit	Sem IV	Credit	Sem V	Credit	Sem VI	Credit
1.1. Language	3	2.1. Language	3	3.1. Language	3	4.1. Language	3	5.1 Core Course – \CC IX	4	6.1 Core Course – CC XIII	4
1.2 English	3	2.2 English	3	3.2 English	3	4.2 English	3	5.2 Core Course – CC X	4	6.2 Core Course – CC XIV	4
1.3 Core Course – CC I	4	2.3 Core Course – CC III	4	3.3 Core Course – CC V	4	4.3 Core Course – CC VII Core Industry Module	3	5. 3.Core Course CC -XI	4	6.3 Core Course – CC XV	4
1.4 Core Course – CC II	4	2.4 Core Course – CC IV	4	3.4 Core Course – CC VI	4	4.4 Core Course – CC VIII	4	5. 4.Core Course – / Project with viva-voce CC -XII	4	6.4 Elective - VII Generic/ Discipline Specific	3
1.5 Elective I Generic/ Discipline Specific	5	2.5 Elective II Generic/ Discipline Specific	5	3.5 Elective III Generic/ Discipline Specific	5	4.5 Elective IV Generic/ Discipline Specific	6	5.45 Elective V Generic/ Discipline Specific	3	6.5 Elective VIII Generic/ Discipline Specific	3
1.6 Skill Enhancement Course SEC-1 (NME)	2	2.6 Skill Enhancement Course SEC-2 (NME)	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	4.6 Skill Enhancement Course SEC-6	2	5.6 Elective VI Generic/ Discipline Specific	3	6.6 Extension Activity	1
1.7 Skill Enhancement - (Foundation Course)	2	2.7 Skill Enhancement Course – SEC-3	2	3.7 Skill Enhancement Course SEC-5	2	4.7 Skill Enhancement Course SEC-7	2	5.7 Value Education	2	6.7 Professional Competency Skill	2
				3.8 E.V.S	-	4.8 E.V.S	2	5.8 Summer Internship /Industrial Training	2		
	23		**23**		**22**		**25**		**26**		**21**
	Total Credit Points										**140**

5. Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	3	24
Part V	-	-	-	-	-	-	-
Total	23	23	22	25	26	21	**140**

***Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree**

B.Sc. Mathematics Curriculum Design

First Year Semester-I

Part	Subject Code	List of Courses	Credit	Hours per week (L/T/P)
Part-I		Tamil-I	3	6
Part-II		English-I	3	6
Part-III	23UMACT01	Algebra &Trigonometry	4	4
	23UMACT02	Differential Calculus	4	4
	Elective Course-1	Paper-I Allied Physics-I/ C Programming Language Theory	3	4
	Practical	Paper-I Allied Physics-I/ C Programming Language Practical	2	2
Part-IV		Skill Enhancement Course (SEC-1) (Non Major Elective)	2	2
	Foundation Course FC 23UMAFC01	Bridge Mathematics	2	2
			23	**30**

Semester-II

Part	Subject Code	List of Courses	Credit	Hours per week (L/T/P)
Part-I		Tamil-II	3	6
Part-II		English-II	3	4
Part-IV	**NMSDC**	**Overview of English Language Communication**	**2**	**2**
Part-III	23UMACT03	Analytical Geometry (Two & Three Dimensions)	4	4
	23UMACT04	Integral Calculus	4	4
	Elective Course-1	Paper-II- Allied Physics-II/ C Programming Language Theory	3	4
	Practical	Paper-II -Allied Physics -II/ C Programming Language Practical	2	2
Part-IV		Skill Enhancement Course (SEC-2) (Non Major Elective)	2	2
	23UMASE03	Skill Enhancement Course (SEC-3) Computational Mathematics (Theory Paper)	2	2
			25	**30**

Second Year Semester-III

Part	Subject Code	List of Courses	Credit	Hours per week (L/T/P)
Part-I		Tamil-III	3	6
Part-II		English – III	3	6
Part-III	23UMACT05	Vector Calculus and its Applications	4	4
	23UMACT06	Differential Equations and its Applications	4	4
	Elective Course- 2	Paper-I Allied Chemistry-I/ Statistical Methods Theory	3	4
	Practical	Paper-I -Allied Chemistry-I/ Statistical Methods Practical	2	2
Part-IV	23UMASE04	Skill Enhancement Course (Entrepreneurial Based) (SEC-4) Statistics with Excel Programming (Theory Paper)	1	1
	NMSDC	Digital Skills for Employability-Digital Skills	2	2
		Environmental Studies	-	1
		Health and Wellness	**1**	
			23	**30**

Semester-IV

Part	Subject Code	List of Courses	Credit	Hours per week (L/T/P)
Part-I		Tamil-IV	3	6
Part-II		English-IV	3	6
Part-III	23UMACT07	Industrial Statistics	3	3
	23UMACT08	Elements of Mathematical Analysis	4	4
	Elective Course- 2	Paper-II-Allied Chemistry-II/ Statistical Methods Theory	4	4
	Practical	Paper-II Allied Chemistry II/ Statistical Methods Practical	2	2
Part-IV	**NMSDC**	**Data Analytics & Visualization**	**2**	**2**
	23UMASE07	Skill Enhancement Course (SEC-7) LaTeX Practical	2	2
		Environmental Studies	2	1
			25	**30**

Third Year Semester-V

Part	Subject Code	List of Courses	Credit	Hours per week (L/T/P)
Part-III	23UMACT09	Abstract Algebra	4	5
	23UMACT10	Real Analysis	4	5
	23UMACT11	Mathematical Modelling	4	4
	23UMACT12	Optimization Techniques	4	4
		Elective Course – I (From Group-I)	3	5
		Elective Course – II (From Group-I)	3	5
Part-IV		Value Education Yoga	2	2
		Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	-
			26	**30**

Semester-VI

Part	Subject Code	List of Courses	Credit	Hours per week (L/T/P)
Part-III	23UMACT13	Linear Algebra	4	6
	23UMACT14	Complex Analysis	4	6
	23UMACT15	Mechanics	4	6
		Elective Course – III (From Group-II)	3	5
		Elective Course – IV (From Group-II)	3	5
Part-IV	23UMAPC01	Professional Competency Skill - Statistics with R Programming (Theory Paper)	2	2
		Extension Activity **	1	-
			21	**30**
		Total Credit	**143**	

Elective Course for the I year B. Sc Mathematics:

Name of the course	Paper Code
Paper I- Allied Physics -I & Practical-I	
Paper II- Allied Physics -II & Practical – II	
Paper I- C Programming Language & Practical	
Paper II- C Programming Language& Practical	

Elective Course for the II year B. Sc Mathematics:

Name of the course	Paper Code
Paper I- Allied Chemistry-I & Practical-I	
Paper II- Allied Chemistry-II & Practical-II	
Paper I- Statistical Methods	
Paper II- Statistical Methods	
Paper III- Statistical Methods Practical	

Elective Course for the III year B. Sc Mathematics: Group-I

Name of the course	Paper Code
Numerical Methods with Applications	23UMAME01
Number Theory	23UMAME02
Mathematical Statistics	23UMAME03

Elective Course for the III year B. Sc Mathematics: Group-II

Name of the course	Paper Code
Difference Equations with Applications	23UMAME04
Discrete Mathematics	23UMAME05
Graph Theory with Applications	23UMAME06

Elective/Allied Mathematics

Name of the course	Paper Code
Paper I- Allied Mathematics-I	23UMAAT01
Paper II- Allied Mathematics-II	23UMAAT02
Allied Mathematics-Practical *	23UMAAP01

* Examination at the end of the II-Semester.

** No Examination-Participation in NCC/NSS/RRC/YRC/Others if any.

Elective Courses Generic Specific for All Computer Science Departments

Name of the Course	Paper Code
Theory #	
Discrete Mathematics-I	23UMAEGS01
Discrete Mathematics-II	23UMAEGS02
Numerical Methods	23UMAEGS03
Optimization Techniques	23UMAEGS04
Introduction to Linear Algebra	23UMAEGS05
Graph Theory and its Applications	23UMAEGS06
Numerical Methods-I	23UMAEGS07
Numerical Methods-II	23UMAEGS08
Practicals*	
Discrete Mathematics	23UMAEGSP01
Numerical Methods	23UMAEGSP02
Optimization Techniques	23UMAEGSP03
Introduction to Linear Algebra	23UMAEGSP04
Graph Theory and its Applications	23UMAEGSP05

For **Odd Semester (I / III)**

Lecture Hours – 6/Week, Lab Hours – Nil, Total Credit – 5.

For **Even Semester (II/ IV)**

Lecture Hours – 4/Week, Lab Hours – 2/Week, Total Credit – 5 (Theory – 3 and Practical – 2).

* **Practical's to be selected only in Even Semester II / IV and Examination at the end of the Even Semester (End Semester).**

QUESTION PAPER PATTERN FOR UG

EXAMINATION SYSTEM

There are two components in the evaluation and assessment of a student, namely Continuous Internal Assessment (CIA) and Semester Examination (SE). The CIA will take place during the course of the semester and the semester Examination shall be conducted at the end of each semester. Each UG course consists of six semesters.

SEMESTER EXAMINATION QUESTION PAPER PATTERN FOR THE THEORY PAPERS

The Maximum Marks for Semester Examination is 75 for UG.

The question paper shall have three Parts with the maximum of 75 marks for three hours with the following break-up.

Part-A

Part-A shall contain ***fifteen*** Multiple Choice Questions drawn from all the units on the basis of three questions from each unit.

Each question shall carry one mark (15×1=15 Marks). Answer all the questions.

Part-B

Part-B shall contain ***five*** questions drawn one each from the 5 units.

2 questions out of 5 are to be answered. Each question shall carry five marks (2×5=10 Marks). Answer any two questions.

Part-C

Part-C shall contain ***five*** –EITHER OR‖ type questions drawn from all the 5 units. One –EITHER OR‖ type question from each unit.

Each question shall carry 10 marks (5×10=50 Marks). Answer all the questions.

QUESTION PAPER PATTERN FOR THE FOLLOWING SKILL ENHANCEMENT COURSES IS 75 OBJECTIVE TYPE QUESTIONS EACH CARRYING 1 MARK.

i. Mathematics for Competitive Examination – I
ii. Mathematics for Competitive Examination - II
iii. Mathematics for Competitive Examination - III
iv. Mathematics for Competitive Examination – IV

CONTINUOUS INTERNAL ASSESSMENT (CIA)

The break-up of the internal marks components is as follows:

(i) CIA Tests – 15 Marks
(ii) Attendance – 5 Marks
(iii) Problem Solving/Assignment – 5 Marks

MARKS AND QUESTION PAPER PATTERN FOR PRACTICALS

The Maximum Marks for Practical Examination is 100 for UG.

External Mark Components 60 Marks. Practical Examination 45 Marks and Record 15 Marks. Internal Mark 40 Marks.

QIESTION PATTERN FOR THE PRACTICAL EXAM PAPERS

Answer any THREE questions out of 5 questions ($3 \times 15=45$Marks).

PASSING MINIMUM

The candidate shall be declared to have passed the examination if the candidates secure not less than 30 marks out of 75 marks in the semester examination in each theory course and in total (CIA mark + Theory Exam mark) not less than 40 marks.

The candidates shall be declared to have passed the examination if he/she secures not less than 40 marks in total (CIA mark + Practical Exam mark) with minimum of 18 marks out of 45 marks in the Practical Exam conducted by the University. There is no passing minimum for the record notebook. However, submission of the record notebook is necessary. Candidate who does not obtain the required minimum marks for a pass in a Course/Practical shall be declared Re-Appear (RA) and the candidate has to appear and pass the same at a subsequent appearance.

B.Sc., Mathematics
Syllabus with effect from the
Academic year
2023-2024

Syllabus for different Courses of B. Sc Mathematics

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">FOUNDATION COURSE- BRIDGE MATHEMATICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">FOUNDATION – FC01</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement Course</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UMAFC01</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td>--</td><td colspan="2">2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12^{th} Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To bridge the gap and facilitate transition from higher secondary to tertiary education;
To instil confidence among stakeholders and inculcate interest for Mathematics;</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="6">UNIT-I: Algebra: Binomial theorem, General term, middle term, problems based on these concepts NCERT -(11^{th} standard)[Chapter -8 , Page No: 160-176]</td></tr>
<tr><td colspan="6">Unit II: Sequences and series (Progressions). Fundamental principle of counting. Factorial n. NCERT -(11^{th} standard)[Chapter -9 , Page No: 177-196]</td></tr>
<tr><td colspan="6">Unit III: Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements within groups, formation of groups. Volume I (11^{th} standard)[Chapter -4, Sec. 4.4-4.5 Page No: 167-186]</td></tr>
<tr><td colspan="6">Unit IV: Trigonometry: Introduction to trigonometric ratios, proof of sin(A+B), cos(A+B), tan(A+B) formulae, multiple and sub multiple angles, sin(2A), cos(2A), tan(2A) etc., transformations sum into product and product into sum formulae, inverse trigonometric functions, sine rule and cosine rule
Volume I (11^{th} standard)
[Chapter -3, Sec. 3.5, 3.5.2, 3.5.3 Page No: 104-122]
[Chapter -3, Sec. 3.7.1-3.7.2 Page No: 134-137]

Inverse trigonometric functions, sine rule and cosine rule
Volume I (12^{th} standard) [Chapter -4, Page No: 132-142]</td></tr>
</table>

	Unit V: Calculus: Limits, standard formulae and problems, differentiation, first principle, uv rule, u/v rule, methods of differentiation, application of derivatives, integration - product rule and substitution method. Volume II (11^{th} standard) [Chapter -9, Sec. 9.2.1, 9.2.10 Page No: 88-103] [Chapter -10, Sec. 10.2.3 Page No: 114-118] [Chapter -11, Sec. 11.7 Page No: 196-209]
Recommended Text	1. NCERT class XI text books. First edition February 2006 , reprint 2019. Unit I & II. 2. State Board Mathematics text books of class XI, Volume – 1 . Revised edition 2019 , 2020. UNIT III, 3. State Board Mathematics text books of class XI , volume -1 revised edition 2019, 2020 and class XII volume- 1 revised edition 2020, 2022 UNIT IV, 4. State Board Mathematics text books of class XI , volume -2 revised edition 2019 , UNIT V.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome

After completion of this course successfully, the students will be able to

CLO1: Prove the binomial theorem and apply it to find the expansions of any $(x + y)^n$ and also, solve the related problems

CLO2: Find the various sequences and series and solve the problems related to them. Explain the principle of counting.

CLO3: Find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations

CLO4: Explain various trigonometric ratios and find them for different angles, including sum of the angles, multiple and submultiple angles, etc. Also, they can solve the problems using the transformations.

CLO5: Find the limit and derivative of a function at a point, the definite and indefinite integral of a function. Find the points of min/max of a function.

Mapping of Course Learning Outcomes (CLOs) with Programme Learning Outcomes (PLOs) and Programme Specific Outcomes (PSOs)

	Pos						PSOs	
	1	2	3	4	5	6	1	2
CLO1	1	1	1	1	1	1	1	1
CLO2	2	1	1	2	2	1	2	1
CLO3	2	1	1	2	2	1	2	1
CLO4	1	1	1	1	1	1	2	1
CLO5	1	1	1	1	1	1	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">ALGEBRA & TRIGONOMETRY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE M1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT01</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">--</td><td>--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• Basic ideas on the Theory of Equations, Matrices and Number Theory.
• Knowledge to find expansions of trigonometry functions, solve theoretical and applied problems.</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="7">Unit I: Reciprocal Equations-Standard form–Increasing or decreasing the roots of a given equation- Removal of terms, Approximate solutions of roots of polynomials by Horner‘s method – related problems.
(Book1 – Chapter6: Sections 16,17,19,30).</td></tr>
<tr><td colspan="7">Unit II: Summation of Series: Binomial– Exponential –Logarithmic series (Theorems without proof) – Approximations - related problems.
(Book1 – Chapter3: Sections 10,14; Chapter4: Sections-1,2,3,5,7,8,9. 11).</td></tr>
<tr><td colspan="7">Unit III: Inverse of a square matrix up to order 3, Characteristic equation –Eigen values and Eigen Vectors-Similar matrices - Cayley – Hamilton Theorem (Statement only) - Finding powers of square matrix, Diagonalization of square matrices - related problems.
(Book2 – Chapter2: Sections -8,16).</td></tr>
<tr><td colspan="7">Unit IV: Expansions of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$, $\cos\theta$ - Expansion of $\tan n\theta$ in terms of $\tan\theta$, Expansions of $\cos^n\theta$, $\sin^n\theta$, $\cos^m\theta\sin^n\theta$ –Expansions of $\tan(\theta_1+\theta_2+,\ldots,+\theta_n)$-Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in terms of θ - related problems.
(Book3 - Chapter3: Sections 1 to 5).</td></tr>
</table>

	Unit V: Hyperbolic functions – Relation between circular and hyperbolic functions Inverse hyperbolic functions, Logarithm of complex quantities, Summation of trigonometric series - related problems. (Book3 - Chapter4; Chapter5; Chapter6: Sections 1,3,3.1 Related problems.)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, problem solving, analytical ability, professional competency, professional communication and transferable skill.
Recommended Text	1. Manickavasagam Pillai, T.K., T. Natarajan and Ganapathy KS – Algebra Vol-I, Viswanathan Publishers and Printers Pvt Ltd., - 2008. 2. Manickavasagam Pillai, T.K., T. Natarajan and Ganapathy KS – Algebra Vol-II, Viswanathan Publishers and Printers Pvt Ltd., - 2008. 3. Manichavasagam Pillai, T.K. and S. Narayanan, Trigonometry– Viswanathan Publishers and Printers Pvt. Ltd. 2013.
Reference Books	1. W.S. Burnstine and A.W. Panton, Theory of equations 2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007 3. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005 4. C.V.Durell and A. Robson, Advanced Trigonometry, Courier Corporation, 2003 5. J.Stewart, L. Redlin, and S. Watson, Algebra and Trigonometry, Cengage Learning, 2012. 6. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010.

Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Classify and Solve reciprocal equations

CLO 2: Find the sum of binomial, exponential and logarithmic series

CLO 3: Find Eigen values, eigen vectors, verify Cayley – Hamilton theorem and diagonalize a given matrix

CLO 4: Expand the powers and multiples of trigonometric functions in terms of sine and cosine

CLO 5: Determine relationship between circular and hyperbolic functions and the summation of trigonometric series

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	1	-	-	3	2	1
CLO3	3	1	3	1	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	-	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DIFFERENTIAL CALCULUS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M2</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT02</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
--</td><td>Lab Practice
--</td><td>Total
4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• The basic skills of differentiation, successive differentiation, and their applications.
• Basic knowledge on the notions of curvature, evolutes, involutes and polar co-ordinates and in solving related problems.</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="6">UNIT-I: Successive Differentiation: Introduction (Review of basic concepts) – The n^{th} derivative – Standard results – Fractional expressions – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the n^{th} derivative of a product. (Chapter3: Sections 1.1 to 1.6 and 2.1, Related problems.)</td></tr>
<tr><td colspan="6">UNIT-II: Partial Differentiation: Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient – A special case – Implicit Functions.
(Chapter8: Sections 1.1 to 1.5.)</td></tr>
<tr><td colspan="6">UNIT-III: Partial Differentiation (Continued): Homogeneous functions – Partial derivatives of a function of two variables – Maxima and Minima of functions of two variables - Lagrange‘s method of undetermined multipliers.
(Chapter8: Sections 1.6, 1.7 and Sections 4, 5.)</td></tr>
<tr><td colspan="6">UNIT-IV: Envelope: Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter.
(Chapter10: Sections 1.1 to 1.4.)</td></tr>
</table>

	UNIT-V: Curvature: Definition of Curvature – Circle, Radius and Centre of Curvature –Cartesian formula for the radius of curvature – The coordinates of the centre of curvature- Evolutes and Involutes – Radius of Curvature in Polar Co-ordinates. (Chapter10: Sections 2.1 to 2.6)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. S. Narayanan and T.K. Manicavachagom Pillay, Calculus-Volume I, (2004), S. Viswananthan Printers Pvt. Ltd.
Reference Books	1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002. 2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010. 3. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007. 4. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer- Verlag, New York, Inc., 1989. 5. T. Apostol, Calculus, Volumes I and II. 6. S. Goldberg, Calculus and mathematical analysis.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Find the nth derivative, form equations involving derivatives and apply Leibnitz formula

CLO 2: Find the partial derivative and total derivative coefficient

CLO 3: Determine maxima and minima of functions of two variables and to use the Lagrange's method of undetermined multipliers

CLO 4: Find the envelope of a given family of curves

CLO 5: Find the evolutes and involutes and to find the radius of curvature using polar co-ordinates

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	-	-	-	3	2	1
CLO3	3	2	3	2	-	-	3	2	1
CLO4	3	2	3	2	1	-	3	2	1
CLO5	3	2	3	2	1	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">ANALYTICAL GEOMETRY (Two & Three Dimensions)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE M3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT03</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">--</td><td>--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• Necessary skills to analyse characteristics and properties of two- and three-dimensional geometric shapes.
• To present mathematical arguments about geometric relationships.
• To solve real world problems on geometry and its applications.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT-I: Pole, Polar - conjugate points and conjugate lines – diameters – conjugate diameters of an ellipse - semi diameters- conjugate diameters of hyperbola. (Book1: Chapter9, 10)</td></tr>
<tr><td colspan="7">UNIT-II: Polar coordinates: General polar equation of straight line – Polar equation of a circle given a diameter, Equation of a straight line, circle, conic – Equation of chord, tangent, normal. Equations of the asymptotes of a hyperbola. (Book2: Chapter9)</td></tr>
<tr><td colspan="7">UNIT-III: System of Planes-Length of the perpendicular–Orthogonal projection. (Book3: Chapter2:Sections 2.5,2.7,2.9)</td></tr>
<tr><td colspan="7">UNIT-IV: Representation of line–angle between a line and a plane – co – planar lines–shortest distance between two skew lines –length of the perpendicular–intersection of three planes.
(Book3: Chapter3:Sections 3.1, 3.2, 3.4, 3.6, 3.7, 3.8)</td></tr>
<tr><td colspan="7">UNIT-V: Equation of a sphere-general equation-section of a sphere by a plane-equation of the circle- tangent plane- angle of intersection of two spheres- condition for the orthogonality- radical plane.
(Book3: Chapter6:Sections 6.1, 6.2, 6.3, 6.4, 6.6, 6.7, 6.8)</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Vittal P.R. and Malini V, Algebra, Analytical Geometry& Trignometry,Margam Publications, India.2018. 2. Manicavachagom Pillay T.K.and Natarajan T, A Text book of Analytical Geometry Part I-Two Dimensions, Divya Subramanian for Ananda Book Depot. 1996. 3. Shanti Narayan and Mittal P.K., Analytical Solid Geometry, S Chand Publishing, 2021.

Reference Books	1. S. L. Loney, Co-ordinate Geometry. 2. Robert J. T. Bell, Co-ordinate Geometry of Three Dimensions. 3. William F. Osgood and William C. Graustein, Plane and Solid Analytic Geometry, Macmillan Company, New York, 2016. 4. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010. 5. Robert C. Yates, Analytic Geometry with Calculus, Prentice Hall, Inc., New York, 1961. 6. Earl W. Swokowski and Jeffery A. Cole, Algebra and Trigonometry with Analytic Geometry, Twelfth Edition, Brooks/Cole, Cengage Learning, CA, USA, 2010. 7. William H. McCrea, Analytical Geometry of Three Dimensions, Dover Publications, Inc, New York, 2006. 8. John F. Randelph, Calculus and Analytic Geometry, Wadsworth Publishing Company, CA, USA, 1969. 9. Ralph Palmer Agnew, Analytic Geometry and Calculus with Vectors, McGraw-Hill Book Company, Inc. New York, 1962.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Find pole, polar for conics, diameters, conjugate diameters for ellipse and hyperbola

CLO 2: Find the polar equations of straight line and circle, equations of chord, tangent and normal and to find the asymptotes of hyperbola

CLO 3: Explain in detail the system of Planes

CLO 4: Explain in detail the system of Straight lines

CLO 5: Explain in detail the system of Spheres

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	2	2	2	1	-	-	3	2	1
CLO2	2	2	2	1	-	-	3	2	1
CLO3	3	2	2	1	-	-	3	2	1
CLO4	3	2	3	1	-	-	3	2	1
CLO5	3	2	3	1	-	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">INTEGRAL CALCULUS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE M4</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT04</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
--</td><td>Lab Practice
--</td><td>Total
4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• Knowledge on integration and its geometrical applications, double, triple integrals and improper integrals.
• Knowledge about Beta and Gamma functions and their applications.
• Skills to Determine Fourier series expansions.</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="7">UNIT-I: Reduction formulae -Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions - Bernoulli‘s formula.
(Chapter1: Sections 13 and 14)</td></tr>
<tr><td colspan="7">UNIT-II: Multiple Integrals - definition of double integrals - evaluation of double integrals – double integrals in polar coordinates - Change of order of integration.
(Chapter5: Sections 1, 2.1, 2.2 and 3.1)</td></tr>
<tr><td colspan="7">UNIT-III: Triple integrals –applications of multiple integrals - volumes of solids of revolution - areas of curved surfaces–change of variables - Jacobian.
(Chapter5: Sections 4, 5.1, 5.2, 5.3, 6.1,7 and Chapter6: 1.1,1.2)</td></tr>
<tr><td colspan="7">UNIT-IV: Beta and Gamma functions – infinite integral - definitions– recurrence formula of Gamma functions – properties of Beta and Gamma functions- relation between Beta and Gamma functions - Applications.
(Chapter7: Sections 2.1,2.2,2.3, 3, 4, and 6.)</td></tr>
</table>

	UNIT-V: Geometric Applications of Integration – Areas under plane curves: Cartesian coordinates-Area of a closed curve – Areas in polar coordinates-Trapezoidal rule – Simpson's rule and Physical Applications of Integral calculus – Centroid – Centre of mass of an arc - Centre of mass of a plane area- Centroid of a solid of revolution – Centroid of a surface of revolution . (Chapter2: Sections 1.1 to 1.4 , 2.1,2.2 and Chapter3: 1.1 to 1.5 Simple Applications)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Narayanan S and Manicavachagom Pillay T.K. Calculus-Volume II, (2006), S. Viswananthan Printers Pvt. Ltd.
Reference Books	1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002. 2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007. 3. D. Chatterjee, Integral Calculus and Differential Equations, Tata-McGraw Hill Publishing Company Ltd. 4. P. Dyke, An Introduction to Laplace Transforms and Fourier Series, Springer Undergraduate Mathematics Series, 2001 (second edition).
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae

CLO 2: Evaluate double and triple integrals and problems using change of order of integration

CLO 3: Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution

CLO 4: Explain beta and gamma functions and to use them in solving problems of integration

CLO 5: Explain Geometric and Physical applications of integral calculus

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	3	1	3	-	-	-	3	2	1
CLO3	3	1	3	-	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	2	1	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">VECTOR CALCULUS AND ITS APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE M5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT05</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
--</td><td>Lab Practice
--</td><td>Total
4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• Knowledge about differentiation of vectors and on differential operators. Knowledge about derivatives of vector functions.
• Skills in evaluating line, surface and volume integrals.
• The ability to analyze the physical applications of derivatives of vectors.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT-I: Vector point function - Scalar point function - Derivative of a vector and derivative of a sum of vectors - Derivative of a product of a scalar and a vector point function - Derivative of a scalar product and vector product.
(Chapter1: Sections 1.1 to 1.5)</td></tr>
<tr><td colspan="7">UNIT-II: The vector operator ‗del', The gradient of a scalar point function - Divergence of a vector - Curl of a vector - solenoidal and irrotational vectors – simple applications.
(Chapter2: Sections 2.1 to 2.7.)</td></tr>
<tr><td colspan="7">UNIT-III: Laplacian operator, Vector identities - Line integral - simple problems.
Chapter2: Sections 2.8 and Chapter3: 3.1, 3.2, 3.3, 3.4)</td></tr>
<tr><td colspan="7">UNIT-IV: Surface integral - Volume integral – Applications.
(Chapter3: 3.5, 3.6)</td></tr>
<tr><td colspan="7">UNIT-V: Gauss divergence Theorem, Stoke's Theorem, Green's Theorem in two dimensions – Applications to real life situations.
(Chapter4: 4.1 to 4.5)</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Recommended Text	1. Duraipandian, P and Laxmiduraipandian - Vector Analysis (Revised Edition-Reprint 2005) Emerald Publishers.
Reference Books	1. J.C. Susan ,Vector Calculus, , (4th Edn.) Pearson Education, Boston, 2012. 2. A. Gorguis, Vector Calculus for College Students, Xilbius Corporation, 2014. 3. J.E. Marsden and A. Tromba ,Vector Calculus, , (5^{th}edn.) W.H. Freeman, New York, 1988.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Find the derivative of vector and sum of vectors, product of scalar and vector point function and to Determine derivatives of scalar and vector products

CLO 2: Applications of the operator _del' and to Explain soleonidal and ir-rotational vectors

CLO 3: Solve simple line integrals

CLO 4: Solve surface integrals and volume integrals

CLO 5: Verify the theorems of Gauss, Stoke's and Green's(Two Dimension)

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	1	-	-	3	2	1
CLO2	3	2	3	1	2	-	3	2	1
CLO3	3	3	3	3	-	-	3	3	1
CLO4	3	3	3	3	-	-	3	3	1
CLO5	3	3	3	3	2	-	3	3	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT06</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
--</td><td colspan="2">Lab Practice
--</td><td>Total
4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Knowledge about the methods of solving Ordinary and Partial Differential Equations.
• The understanding of how Differential Equations can be used as a powerful tool in solving problems in science.</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="8">UNIT-I: Ordinary Differential Equations: Variable separable - Homogeneous Equation-Non-Homogeneous Equations of first degree in two variables -Linear Equation - Bernoulli‘s Equation-Exact differential equations.
(Chapter2: Sections 1 to 6)</td></tr>
<tr><td colspan="8">UNIT-II: Equation of first order but of higher degree: Equation solvable for dy/dx- Equation solvable for y-Equation solvable for x-Clairauts‘ form - Linear Equations with constant coefficients-Particular integrals of algebraic, exponential, trigonometric functions and their products.
(Chapter4: Sections 1,2 ,3 and Chapter5: 1 to 4)</td></tr>
<tr><td colspan="8">UNIT-III: Simultaneous linear differential equations- Linear Equations of the Second Order -Complete solution in terms of a known integrals-Reduction to the Normal form-Change of the Independent Variable-Method of Variation of Parameters.
(Chapter6 and Chapter 8: Sections 1 to 4)</td></tr>
</table>

	UNIT-IV: Partial differential equation: Formation of PDE by Eliminating arbitrary constants and arbitrary functions – complete integral – singular integral-General integral-Lagrange's Linear Equations –Simple Applications. (Chapter12: 1,2,3, and 4)
	UNIT-V: Special methods – Standard forms-Charpit's Methods – Simple Applications (Chapter12: 5, and 6)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Narayanan S and Manicavachagom Pillay T.K. Differential equations and its application, 2006, S. Viswananthan Printers Pvt. Ltd.

Reference Books	1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984. 2. I.Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967. 3. G.F. Simmons, Differential equations with applications and historical notes, 2nd Ed, Tata Mcgraw Hill Publications, 1991. 4. D.A. Murray, Introductory course in Differential Equations, Orient and Longman 5. H.T. H.Piaggio, Elementary Treaties on Differential Equations and their applications, C.B.S Publisher & Distributors, Delhi,1985. 6. Horst R. Beyer, Calculus and Analysis, Wiley, 2010. 7. Braun, M. Differential Equations and their Applications. (3rd Edn.), Springer- Verlag, New York. 1983. 8. TynMyint-U and Lognath Debnath. Linear Partial Differential Equations for Scientists and Engineers. (4th Edn.) Birhauser, Berlin. 2007. 9. Boyce, W.E. and R.C.DiPrima. Elementary Differential Equations and Boundary Value Problems. (7th Edn.) John Wiley and Sons, Inc., New York. 2001. 10. Sundrapandian, V. Ordinary and Partial Differential Equations, Tata McGraw Hill Education Pvt.Ltd. New Delhi, 2013
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Determine solutions of homogeneous equations, non-homogeneous equations of degree one in two variables, solve Bernoulli‘s equations and exact differential equations

CLO 2: Find the solutions of equations of first order but not of higher degree and to Determine particular integrals of algebraic, exponential, trigonometric functions and their products

CLO 3: Find solutions of simultaneous linear differential equations, linear equations of second order and to find solutions using the method of variations of parameters

CLO 4: Form a PDE by eliminating arbitrary constants and arbitrary functions, find complete, singular and general integrals, to solve Lagrange‘s equations

CLO 5: Explain standard forms and Solve Differential equations using Charpit‘s method

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	1	-	3	2	1
CLO2	3	1	3	2	1	-	3	2	1
CLO3	3	1	3	2	1	-	3	3	1
CLO4	3	1	3	2	2	1	3	3	1
CLO5	3	1	3	2	2	1	3	3	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">INDUSTRIAL STATISTICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M7</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT07</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
3</td><td colspan="2">Tutorial
--</td><td>Lab Practice
--</td><td>Total
3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To bridge the gap between industry academia interface – to apply the theory learnt to industrial applications</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Introduction- Combinatorial Methods- Binomial coefficients.
(Chapter1: Section-1.1, 1.2, 1.3.)</td></tr>
<tr><td colspan="6">UNIT-II: Probability - Introduction-Sample spaces- Events –The Probability of event- Some Rules of Probability.
(Chapter2: Section-2.1, 2.2, 2.3, 2.4, 2.5.)</td></tr>
<tr><td colspan="6">UNIT-III: Conditional Probability- Independent Events- Baye‘s Theorem(Only problems).
(Chapter2: Section-2.6, 2.7, 2.8.)</td></tr>
<tr><td colspan="6">UNIT-IV: Probability Distributions and Probability Densities- Introduction- Probability Distributions-Continuous Random variables- Probability Density functions-Multivariate Distributions.
(Chapter3: Section-3.1, 3.2, 3.3, 3.4, 3.5.)</td></tr>
<tr><td colspan="6">UNIT-V: Marginal Distributions- Conditional Distributions- Mathematical Expectations- Introduction- The Expected value of a Random variable- Moments.
(Chapter3: Section-3.6, 3.7 and Chapter4: Section- 4.1, 4.2, 4.3.)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication, Transferrable Skill and designing mathematical models towards solving mathematical applications</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Fruend John E, Mathematical Statistics, Prentice Hall of India, New Delhi.</td></tr>
</table>

Reference Books	1. Papoulis A. Probability, Random Variables and Stochastic process, Tata McGraw Hill Education Pvt. Ltd., New Delhi 2. Baisnab A., Jas M., Elements of Probability and Statistics, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 1993.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Define Combinatorial Methods and few examples

CLO 2: Define Sample spaces and The Probability of event

CLO 3: Describe Independent Events and problems

CLO 4: Define Probability Distributions, Continuous Random variables

CLO 5: Describe Conditional Distributions and Mathematical Expectations

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	2	3	3	2	2	3	1
CLO2	2	3	3	3	3	2	2	3	1
CLO3	3	3	3	3	3	2	2	3	1
CLO4	2	3	3	2	3	2	2	3	1
CLO5	2	3	3	3	3	2	2	3	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">ELEMENTS OF MATHEMATICAL ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE M8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT08</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
--</td><td>Lab Practice
--</td><td>Total
4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• Identify and characterize sets and functions and Understand, test and analyze the convergence and divergence of sequences, series.
• Understand metric spaces with suitable examples</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT-I: Sets and Functions: Sets and elements- Operations on sets- functions- real valued functions- equivalence- countability- real numbers- least upper bounds.
(Chapter1: Section-1.1 to 1.7)</td></tr>
<tr><td colspan="7">UNIT-II: Sequences of Real Numbers: Definition of a sequence and subsequence-limit of a sequence – convergent sequences–divergent sequences- bounded sequences-monotone sequences
(Chapter2: Section-2.1 to 2.6)</td></tr>
<tr><td colspan="7">UNIT-III: Operations on convergent sequences – operations on divergent sequences – limit superior and limit inferior-Cauchy sequences.
(Chapter2: Section-2.7 to 2.10)</td></tr>
<tr><td colspan="7">UNIT-IV: Series of Real Numbers: Convergence and divergence – series with non –negative terms-alternating series-conditional convergence and absolute convergence- tests for absolute convergence.
(Chapter3: Section-3.1 to 3.4 and 3.6)</td></tr>
<tr><td colspan="7">UNIT-V: Limits and Metric Spaces: Limit of a function on the real line - Metric spaces - Limits in metric spaces – Continuous Functions on Metric Spaces: Function continuous at a point on the real line-Function continuous on a metric space.
(Chapter4: Section-4.1 to 4.3 and Chapter5: 5.1 ,5.3)</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Richard R. Goldberg, Methods of Real Analysis: Oxford and IBH Publishing, 2017.
Reference Books	1. Ethan D. Bloch, The Real Numbers and Real Analysis, Springer, 2011. 2. G.M. The fundamentals of Mathematical Analysis, vol I. Pergamon Press, New York, 1965. 3. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002. 4. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000. 5. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983. 6. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain in detail about sets and functions, equivalence and countability and the LUB axiom

CLO 2: Explain Sequence and Subsequence of real numbers and to find the limit of sequence to test for convergent, divergent, bounded and monotone sequences

CLO 3: Explain the operations on convergent and divergent sequences and to Explain the concepts of limit superior and limit inferior and the notion of Cauchy sequences

CLO 4: Classify the series of real numbers and the alternating series and their convergence and divergence, the conditional convergence and absolute convergence and solve problems on convergence of the sequences

CLO 5: Explain about the metric spaces and functions continuous on a Metric space

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	2	3	2	-	3	2	1
CLO2	3	3	2	3	2	-	3	2	1
CLO3	3	3	3	3	2	-	3	2	1
CLO4	3	3	3	3	2	-	3	2	1
CLO5	3	3	2	3	2	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">ABSTRACT ALGEBRA</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M9</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT09</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">5</td><td>--</td><td>--</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Concepts of Sets, Groups and Rings.
• Construction, characteristics and applications of the abstract algebraic structures</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Introduction to groups- Subgroups- cyclic groups and properties of cyclic groups- Lagrange‘s Theorem-A counting principle – Examples. (Chapter2: Section-2.1 to 2.5)</td></tr>
<tr><td colspan="6">UNIT-II: Normal subgroups and Quotient group- Homomorphism- Automorphism -Examples. (Chapter2: Section-2.6 to 2.8)</td></tr>
<tr><td colspan="6">UNIT-III: Cayley‘s Theorem-Permutation groups - Examples (Chapter2: Section-2.9 to 2.10)</td></tr>
<tr><td colspan="6">UNIT-IV: Definition and examples of ring- Some special classes of rings- homomorphism of rings- Ideals and quotient rings- More ideals and quotient rings. (Chapter3: Section-3.1 to 3.5)</td></tr>
<tr><td colspan="6">UNIT-V: The field of quotients of an integral domain-Euclidean Rings - The particular Euclidean Ring – Examples (Chapter3: Section-3.6 to 3.8)</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

Recommended Text	Topics in Algebra–I.N.Herstein, Wiley Eastern Ltd. Second Edition, 2006.
Reference Books	1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002. 2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011. 3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain groups, subgroups and cyclic groups

CLO 2: Explain about Normal subgroup, Quotient groups, Homomorphisms and Automorphisms and verify the functions for homomorphism and automorphism properties

CLO 3: Explain Permutation groups and apply Cayley‘s theorem to problems

CLO 4: Explain Rings, Ideals and Quotient Rings and examine their structure

CLO 5: Discuss about the field of quotient of an integral domain and to Explain in detail about Euclidean Rings

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	2	3	1	-	3	3	1
CLO2	3	3	2	3	1	-	3	3	1
CLO3	3	3	2	3	2	-	3	3	1
CLO4	3	3	2	3	1	-	3	3	1
CLO5	3	3	2	3	2	-	3	3	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">REAL ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M10</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT10</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">--</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Real Numbers and properties of Real–valued functions.
• Connectedness, Compactness, Completeness of Metric spaces.
• Convergence of sequences of functions, Examples and counter examples</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Continuous Functions on Metric Spaces: Open sets– closed sets–Discontinuous function on R^1. Connectedness, Completeness and Compactness: More about open sets-Connected sets.
(Chapter5: Section-5.4 to 5.6 and Chapter6: Sections-6.1,6.2)</td></tr>
<tr><td colspan="6">UNIT-II: Bounded sets and totally bounded sets: Complete metric spaces- compact metric spaces, continuous functions on compact metric space, continuity of inverse functions, uniform continuity.
(Chapter6: Sections-6.3 to 6.8)</td></tr>
<tr><td colspan="6">UNIT-III: Calculus: Sets of measure zero, definition of the Riemann integral, existence of the Riemann integral, properties of Riemann integral. (Chapter7: Sections-7.1 to 7.4)</td></tr>
<tr><td colspan="6">UNIT-IV: Derivatives- Rolle‘s theorem, The Law of mean, Fundamental theorems of calculus. (Chapter7: Sections-7.5 to 7.8)</td></tr>
<tr><td colspan="6">UNIT-V: Taylor‘s theorem-Point wise convergence of sequences of functions, uniform convergence of sequences of functions
(Chapter8: Sections-8.5and Chapter9: Sections-9.1,9.2)</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Methods of Real Analysis-Richard R.Goldberg (John Wiley & sons, 2nd edition) (Indian edition –Oxford and IBH Publishing Co, New Delhi, 1st January 2020)
Reference Books	1. Principles of Mathematical Analysis by Walter Rudin, Tata McGraw Hill Education, Third edition (1 July 2017). 2. Mathematical Analysis Tom M A postal, Narosa Publishing House, 2nd edition (1974), Addison-Wesley publishing company, New Delhi.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain the concepts of Continuous and Discontinuous functions, open and close sets, Connectedness, Completeness and Compactness

CLO 2: Explain the concepts of bounded and totally bounded sets, continuity of inverse functions and Uniform continuity

CLO 3: Define the sets of measure zero, to Explain about the existence and properties of Riemann integral

CLO 4: Explain the concept of differentiability and to Explain Rolle‘s theorem, Law of mean, and Fundamental theorem of calculus

CLO 5: Explain the point wise and uniform convergence of sequence of function and to derive the Taylor‘s theorem

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	1	3	1	-	3	1	1
CLO2	3	3	1	3	1	-	3	1	1
CLO3	3	3	1	3	1	-	3	1	1
CLO4	3	3	1	3	1	-	3	1	1
CLO5	3	3	1	3	1	-	3	1	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICAL MODELLING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M11</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">21UMACT11</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
--</td><td>Lab Practice
--</td><td>Total
4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Construction and Analysis of Mathematical models found in real life problems.
• Modelling through differential and difference equations</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT-I: Mathematical Modelling: Simple situations requiring mathematical modelling, characteristics of mathematical models.
(Chapter1: Section-1.1, 1.4)</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II: Mathematical Modelling through differential equations: Linear Growth and Decay Models. Non-Linear growth and decay models, Compartment models.
(Chapter2: Section-2.1 to 2.4)</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-III: Mathematical Modelling, through system of Ordinary differential equations of first order: Prey-predator models, Competition models, Model with removal and model with immigrations. Epidemics: simple epidemic model, Susceptible-infected- susceptible (SIS) model, SIS model with constant number of carriers. Medicine: Model for Diabetes Mellitus.
(Chapter3: Section-3.1: 3.1.1, 3.1.2; 3.2: 3.2.1to 3.2.4, 3.2.6, 3.5:3.5.1)</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT – IV: Introduction to difference equations.
(Chapter5: Section-5.1, 5.2: 5.2.1, 5.2.2, 5.2.3)</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-V: Mathematical Modelling through difference equations: Harrod Model, cob web model application to Actuarial Science
(Chapter5: Section-5.3: 5.3.1, 5.3.2, 5.3.4)</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. J N Kapur, Mathematical Modeling, New Age International publishers(2009).
Reference Books	1. Mathematical Modeling by Bimalk. Mishra and Dipak K.Satpathi. Ane Books Pvt. Ltd(1 Januuary 2009) 2. Mathematical Modeling Models, Analysis and Applications, by Sandip Banerjee, CRC Press, Taylor & Francis group, 2014 3. Mathematical Modeling applications with Geogebra by Jonas Hall & Thomas Ligefjard, John Wiley & Sons, 2017 4. Mark M. Meerschaert: Mathematical Modeling, Elsevier Publ., 2007. 5. Edward A. Bender: An introduction to mathematical Modeling, CRC Press,2002 6. Walter J. Meyer, Concepts of Mathematical Modeling, Dover Publ., 2000
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain simple situations requiring Mathematical Modelling and to Determine the characteristics of such models

CLO 2: Model using differential equations in-terms of linear growth and Decay models

CLO 3: Model using systems of ordinary differential equations of first order, to discuss about various models under the categories _Epidemics‘ and _Medicine‘

CLO 4: Explain in detail about difference equations

CLO 5: Model using difference equations

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	2	3	3	3	2	2	2	3	2
CLO2	2	3	3	3	2	2	2	3	2
CLO3	2	3	3	3	2	2	2	3	2
CLO4	3	2	2	2	-	1	2	3	2
CLO5	2	3	3	3	2	2	2	3	2

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">OPTIMIZATION TECHNIQUES</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M12</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td>Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT12</td></tr>
<tr><td>Semester</td><td>V</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours Per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td colspan="2">-</td><td>4</td></tr>
<tr><td colspan="2">Pre- requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objective of the Course</td><td colspan="6">• To provide knowledge on Formulating real life problems into LP.P
• To teach the techniques for converting the industrial problems as mathematical problems and solving them.</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="6">UNIT I :
Operations Research – An Overview: Introduction to Operations Research – Modeling in O.R-Advantages and limitations of models – Linear Programming Problem (LPP) – Mathematical formulation –Illustrations on Mathematical formulation of LPP‘s - Graphical solution – Some exceptional cases-Introduction(Simplex method) – Computational Procedure-Big-M method only.
(Chapter1:Sections 1.1 ,1.5 & 1.6; Chapter2: Sections 2.1 to 2.4; Chapter3:Sections 3.1 to 3.3; Chapter4:Sections 4.1, 4.3, 4.4)</td></tr>
<tr><td colspan="6">UNIT II :
Transportation Problem : Introduction - Mathematical formulation – North West Corner rule - Matrix Minima method – Vogel‘s Approximation Method – Degeneracy in TP- MODI method – Some exceptional Cases(Unbalanced TP &Maximization case in TP).
Assignment Problem : Introduction - Mathematical formulation - Hungarian method – Special cases in AP(Unbalanced AP& Maximization case in AP)– Travelling Salesman Problem.
(Chapter10:Sections 10.1, 10.2, 10.9, 10.12,10.13, 10.15
Chapter11: Sections 11.1 to 11.3 &11.4, 11.7)</td></tr>
<tr><td colspan="6">UNIT III :
Sequencing problem – Introduction –Problem of sequencing- Basic in sequencing- n jobs to be operated on two machines – Problems – n jobs to be operated on three machines – Problems – n jobs to be operated on m machines – Problems - Two jobs to be operated on m</td></tr>
</table>

	machines (Graphical method) – Problems. **(** Chapter12: Sections 12.1 to 12.6)
	UNIT IV : **Games and Strategies** - Introduction - Two person zero sum game - -Some basic terms-The maximum and minimum principle games - Games without saddle points - Mixed strategies - Graphical method 2xn and mx2 games-– Dominance Property. (Chapter17:Sections 17.1 to 17.7)
	UNIT V : **Network and scheduling by PERT/CPM :** Introduction– Network basic concepts-Logical Sequencing -Rules of network construction—-Concurrent Activities– Critical Path Analysis–Probability consideration in PERT-Differences between CPM and PERT. (Chapter25: Sections 25.1 to 25.8)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Recommended Text	1. Kantiswarup., Gupta, P.K. and Man Mohan. Operations Research.[Seventeenth Edition]. Sultan Chand and Sons, New Delhi.2020.
Reference Books	1. Gupta, P.K. and Hira, D.S. Operations Research. [Eighth Edition]. Sulthan .Chand and Co., NewDelhi.2020. 2. Gupta, P.K. and Man Mohan. Problems in Operations Research.[Ninth Edition]. Sultan Chand and Sons, New Delhi.2014. 3. Kalavathy.S. Operations Research[Fourth Edition],Vikas Publishing House,Chennai.2012.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1 : Define linear programming problem and to solve the problems using graphical method, Simplex method and Big-M method.

CLO 2 : Solve Transportation problems and Assignment problems.

CLO 3 : Find solutions for sequencing problems.

CLO 4 : Discuss game, strategies on dominance property.

CLO 5 : Construct network and do PERT calculations.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	3	2	1	3	3	3
CLO2	3	2	3	3	2	1	3	3	3
CLO3	3	2	3	3	2	1	3	3	3
CLO4	3	2	3	3	2	1	3	3	3
CLO5	3	2	3	3	2	1	3	3	3

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">LINEAR ALGEBRA</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M13</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT13</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">6</td><td colspan="2">--</td><td>--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Vector Spaces, linear dependence and independence of vectors . Dual spaces, Inner product and norm – orthogonalization process.
• Linear transformations. Various operators on vector spaces</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Vector spaces – Subspaces – Linear Combinations and linear span - Systems of Linear equations – Homogenous Equations – Non-homogenous Equations – Elementary Matrices – Row reduced - Echelon form (Chapter1: Section-1.2 to 1.4; Chapter2: 2.7; Chapter3: 3.1)</td></tr>
<tr><td colspan="6">UNIT-II: Linear Dependence and Linear independence – Bases – Dimensions (Chapter1: Section-1.5, 1.6)</td></tr>
<tr><td colspan="6">UNIT-III: Linear transformations, null spaces and ranges – Matrix representation of a linear transformation –invertibility and isomorphisms – dual spaces(Chapter2: Section-2.1,2.2,2.4, 2.6)</td></tr>
<tr><td colspan="6">UNIT – IV: Eigen values, eigen vectors, diagonalizability – invariant subspaces – Cayley–Hamilton theorem(Chapter5: Section-5.1,5.2, 5.4)</td></tr>
<tr><td colspan="6">UNIT-V: Inner products and norms – Gram Schmidt Orthogonalization Process - Orthogonal complements(Chapter6: Section-6.1,6.2)</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Linear Algebra - Stephen H Friedberg, Arnold J Insel and Lawrence E Spence, 5th edition (2018) Pearson
Reference Books	1. I.N.Herstein, Topics in Algebra, Wiley EasternLtd. Second Edition, 2006. 2. N.S.Gopalakrishnan, University Algebra, New Age International Publications, Wiley Eastern Ltd. 3. John B.Fraleigh, First course in Algebra, Addison Wesley. 4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2004. 5. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007. 6. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005. 7. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Acquire a detailed knowledge about vector spaces and subspaces

CLO 2: Explain the concepts of Linear Dependence, Linear Independence, Bases and Dimension of basis

CLO 3: Explain the concept of Linear Transformations, their Matrix representation and the notion of dual spaces

CLO 4: Find the Eigen values and Eigen vectors, to apply the concepts for diagonalisation

CLO5: Explain about Inner product and norms and to apply Gram Schmidt Orthogonalization Process to problems on inner product spaces

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	2	3	-	-	3	3	1
CLO2	3	3	3	3	-	-	3	3	1
CLO3	3	3	2	3	1	-	3	3	1
CLO4	3	3	3	3	-	-	3	3	1
CLO5	3	3	3	3	1	-	3	3	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">COMPLEX ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M14</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT14</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
6</td><td colspan="2">Tutorial
--</td><td>Lab Practice
--</td><td>Total
6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Apply concept and consequences of analyticity and C-R equations.
• Understand the concept of mappings and transformations.
• Compute complex contour integrals and applying Cauchy_s integral in various versions.
• Understand zeros and singularities of an analytic function, apply their properties in the evaluation of definite integral.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT-I: Analytic functions: Functions of a Complex variable –Limits –Theorem on limits –Continuity – Derivatives – Differentiation formulas – Cauchy Riemann equation – conditions for differentiability – Polar coordinates– Analytic functions– Harmonic functions.
(Chapter2: Section-11,14,15,17,18,19,20,21,22,23,25)</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II: Conformal mapping: Mappings – Mapping by exponential function – Linear transformation – The transformation $w=\frac{1}{z}$– Mappings by $\frac{1}{z}$– Linear fractional transformations (bilinear)
(Chapter2: Section-12,13;Chapter8: Section- 83 to 86)</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-III: Complex Integration: Contour integrals– Some examples – Simply and Multiply connected domains– Cauchy integral formula – Formula for derivatives– Liouville‘s theorem –Fundamental theorem of Algebra– Maximum modulus principle.(Chapter4:39,40,46 to 50)</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT – IV: Sequences and Series: Convergence of sequences – Convergence of series– Taylor‘s series – Laurent series– Absolute and uniform convergence of power Series – Continuity of sums of power series–Integration & differentiation of power series(Chapter5: Section-51,52,53,55,57,58,59)</td></tr>
</table>

	UNIT-V: Residues and Poles: Isolated singular points – Residues – Cauchy Residue theorem –Residue at infinity– The three types of isolated singular points –Residues at poles – Zeros of analytical functions – Zeros and poles – Evaluation of real improper integrals (excluding poles on the real axis). (Chapter6:Section-62,63,65,66,68,69:Chapter7: Section-71)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Complex variables and application, Seventh Edition by James Ward Brown and Ruel V. Churchill, Mc-Graw Hill Book Co., International Edition, 2009.
Reference Books	1. Theodore W. Gamelan, Complex Analysis, Springer Verlag, 2008 2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997. 3. Richard A. Silverman, Introductory Complex Analysis. Dover Publications, 1972. 4. S. Ponnusamy and H. Silverman, Complex variables with applications, Birkhauser, 2006.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain about analytic functions, their differentiation and continuity and to verify the Harmonic functions using analyticity conditions

CLO 2: Explain the concept of Conformal mappings and mappings by linear transformations and linear fractional transformations

CLO 3: Explain about the integrations of functions over simply and multiply connected domains and to derive the Cauchy integral formula, Liouvlle‘s theorem, Fundamental theorem of Algebra and Maximum Module Principle

CLO 4: Find the convergence the sequences and series, to derive Taylor‘s and Laurent‘s series

CLO 5: Find the nature of singularities, to find the residue of a given function at a given singular point, to Explain about zeros and poles and to evaluate real improper integrals (Excluding poles on the real axis)

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	3	2	1	-	3	3	2
CLO2	3	3	3	2	1	-	3	3	2
CLO3	3	3	3	2	1	-	3	3	2
CLO4	3	3	3	2	1	-	3	3	2
CLO5	3	3	3	2	1	-	3	3	2

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">MECHANICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE M15</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMACT15</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
6</td><td colspan="2">Tutorial
--</td><td>Lab Practice
--</td><td>Total
6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• Equilibrium of a particle under the action of given forces
• Simple Harmonic Motion
• Projectiles</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT-I: Force: Newton‘s laws of motion – Resultant of two forces on a particle - Equilibrium of a Particle: Equilibrium of a particle – Limiting equilibrium of a particle on an inclined plane.
(Chapter2: Section-2.1,2.2; Chapter3: Section-3.1,3.2)</td></tr>
<tr><td colspan="7">UNIT-II: Forces on a Rigid Body: Moment of a Force – General motion of a body – Equivalent systems of forces- Parallel Forces – Forces acting along a Triangle - A specific reduction of Forces: Reduction of coplanar forces into a force and couple – Problems involving frictional forces.
(Chapter4: Section-4.1 to 4.5; Chapter5: Sections-5.1,5.2)</td></tr>
<tr><td colspan="7">UNIT-III: Work, Energy and Power: Work – Conservative field of force – Power -Rectilinear Motion under Varying Force: Simple Harmonic Motion - along a horizontal line – along a vertical line.
(Chapter11:Section-11.1,11.2,11.3;Chapter12: Section-12.1,12.2,12.3)</td></tr>
<tr><td colspan="7">UNIT – IV: Projectiles: Forces on a projectile – Projectile projected on an inclined plane (Chapter13: Section-13.1, 13.2)</td></tr>
<tr><td colspan="7">UNIT-V: Central Orbits: General orbits – Central orbit – Conic as a centered orbit. (Chapter16: Section-16.1 to 16.3)</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Duraipandian. P.,LaxmiDuraipandian and MuthamizhJayapragasm-Mechanics. 2007. S.Chand and company.
Reference Books	1. A. Ruina and R. Pratap, Introduction to Statics and Dynamics, , Oxford University Press, 2014. 2. S.L. Loney, The Elements of Statics and Dynamics, Cambridge University Press, 1904.J.L. Meriam and L. G. Kraige, Engineering Mechanics: Statics, Seventh Edition,Wiley and sons Pvt ltd., New York, 2012. 3. J.L. Meriam, L. G. Kraige, and J.N. Bolton, Engineering Mechanics: Dynamics, 8thedn, Wiley and sons Pvt ltd., New York, 2015. 4. A. K. Dhiman,P.Dhinam and D. Kulshreshtha, Engineering Mechanics (Statics and Dynamics) ,McGraw Hill Education(India) Private Limited, New Delhi, 2015.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will able to

CLO 1: Define Resultant, Component of a Force, Coplanar forces, like and unlike parallel forces, Equilibrium of a Particle, Limiting equilibrium of a particle on an inclined plane.

CLO 2: Define Moment of a force and Couple with examples. Define Parallel Forces and Forces acting along a Triangle, Solve problems on frictional forces

CLO 3: Define work, energy, power, rectilinear motions under varying forces. Define Simple Harmonic Motion and find its Geometrical representation.

CLO 4: Define Projectile, impulse, impact and laws of impact. Prove that the path of a projectile is a parabola. Find the direct and oblique impact of smooth elastic spheres

CLO 5: Define central orbits, explain conic as centered orbits and solve problems related to central orbits

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	2	1	1	3	3	2
CLO2	3	2	3	2	1	1	3	3	2
CLO3	3	2	3	2	1	1	3	3	2
CLO4	3	2	3	2	1	1	3	3	2
CLO5	3	2	3	2	1	1	3	3	2

SKILL ENHANCEMENT COURSE

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICS FOR COMPETITIVE EXAMINATION – I</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">SKILL ENHANCEMENT COURSE SEC-01
(Non Major Elective)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td>Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UMASE01</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours Per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">-</td><td>2</td></tr>
<tr><td colspan="2">Pre- requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objective of the Course</td><td colspan="6">• Remembering the meaning of HCF and LCM of numbers.
• Understanding the concept of percentage on simple problems.
• Analyzing the concepts of ratio and proportion.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT – I
Numbers - H.C.F and L.C.M. of Numbers.
(Chapter – 1 & 2)</td></tr>
<tr><td colspan="6">UNIT – II
Decimal Fractions – Simplification.
(Chapter – 3 & 4)</td></tr>
<tr><td colspan="6">UNIT – III
Square Roots and Cube Roots – Average.
(Chapter – 5 & 6)</td></tr>
<tr><td colspan="6">UNIT – IV
Problems on Numbers - Problems on Ages.
(Chapter – 7 & 8)</td></tr>
<tr><td colspan="6">UNIT – V
Surds & Indices – Percentage.
(Chapter – 9 & 10)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. R.S. Aggarwal, Quantitative Aptitude for Competitative Examinations, S.Chand co Ltd., 152. Anna Salai, Chennai,2010</td></tr>
</table>

Reference Books	1. Quantitative Aptitude _'by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005)

Website and e – Learning Source	https://nptel.ac.in

Question Paper Pattern: 75 Objective type questions each carrying 1 Mark.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1 : Perform basic mathematics in Numbers.

CLO 2 : Understand Decimal Fractions and Simplification.

CLO 3 : Develop basic concept of Square Roots and Cube Roots and Average.

CLO 4 : Explain Problems on Numbers - Problems on Ages.

CLO 5 : Critique and evaluate quantitative arguments that utilize mathematics, statistical and quantitative informations.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	1	-	-	3	2	1
CLO3	3	1	3	1	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	-	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICS FOR COMPETITIVE EXAMINATION – II</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">SKILL ENHANCEMENT COURSE SEC-02
(Non Major Elective)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course Code</td><td>23UMASE02</td></tr>
<tr><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours Per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td>2</td><td colspan="2">-</td><td colspan="2">-</td><td>2</td></tr>
<tr><td colspan="2">Pre- requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objective of the Course</td><td colspan="6">• Understanding the concepts of chain rule.
• Applying the concept of time and distance.
• Analyzing the problem on trains with solved examples.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT – I
Profit & Loss – Ratio & Proportion.
(Chapter – 11 & 12)</td></tr>
<tr><td colspan="6">UNIT – II
Partnership – Chain Rule.
(Chapter – 13 & 14)</td></tr>
<tr><td colspan="6">UNIT – III
Time & Work – Pipes & Cistern.
(Chapter – 15 &16)</td></tr>
<tr><td colspan="6">UNIT – IV
Time & Distance – Problems on Trains.
(Chaper – 17 &18)</td></tr>
<tr><td colspan="6">UNIT – V
Boats & Streams – Alligation or Mixture.
(Chaper – 19 &20)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. R.S. Aggarwal, Quantitative Aptitude for Competitative Examinations, S.Chand co Ltd., 152. Anna Salai, Chennai,2010</td></tr>
</table>

Reference Books	1. Quantitative Aptitude _‘by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005)
Website and e – Learning Source	https://nptel.ac.in

Question Paper Pattern: 75 Objective type questions each carrying 1 Mark.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1 : Explain in detail about Profit & Loss and Ratio & Proportion.

CLO 2 : Explain Partnership and Chain Rule.

CLO 3 : Explain Time & Work and Pipes & Cistern.

CLO 4 : Explain Time & Distance and Problems on Trains.

CLO 5 : Explain Boats & Streams and Alligation or Mixture.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	1	-	-	3	2	1
CLO3	3	1	3	1	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	-	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">COMPUTATIONAL MATHEMATICS (THEORY PAPER)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">SKILL ENHANCEMENT COURSE SEC-03</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UMASE03</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td colspan="2">--</td><td>--</td><td colspan="2">2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Understand and use the structure of C++ programme, to solve different Numerical Methods.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Algebraic and Transcendental Equations: Bisection method-Method of false position- Method of successive approximation-Newton-Raphson's method-Secant Method-Graeff's root squaring method.</td></tr>
<tr><td colspan="6">UNIT-II: System of Linear Algebraic Equations: Direct method-Iterative method-Eigen value problems.</td></tr>
<tr><td colspan="6">UNIT-III: C++ Program for Bisection method-C++ Program for Method of false position- C++ Program for Method of successive approximation-C++ Program for Newton-Raphson's method.</td></tr>
<tr><td colspan="6">UNIT-IV: C++ Program for Secant Method-C++ Program for Graeff's root squaring method-C++ Program for Gauss elimination method-C++ Program for Gauss Jordan method.</td></tr>
<tr><td colspan="6">UNIT-V: C++ Program for Jacobian method-C++ Program for Gauss Seidal method-C++ Program for Largest eigen value by power method.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. R.M. Somasundaram and R.M. Chandrasekaran, "Numerical Methods with C++ Programming", Prentice Hall India Pvt. Ltd., New Delhi, 2005.
Reference Books	1. Pallab Ghosh, "Numerical Methods with Computer Programs in C++", Prentice Hall India Pvt. Ltd., New Delhi, 2009. 2. T. Veerarajan and T. Ramachandran, "Numerical Methods with Programs in C", Second Edition, McGraw Hill Education Pvt. Ltd, New Delhi, 2006.
Website and e-Learning Source	https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CLO 1 : Describe the roots of algebraic equations using different methods like, Newton-Raphson method, Secant Method etc.

CLO 2 : Solve system of algebraic equations using direct and iterative methods.

CLO 3 : To write C++ Program to compute roots of algebraic equations using Bisection method, Newton-Raphson method etc.

CLO 4 : To write C++ Program to compute roots of algebraic equations using Secant method, Gauss Jordan method etc.

CLO 5 : To write C++ Program to solve the system of algebraic equations using the Jacobian method, Gauss Seidal method.

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	3	2	3
CO5	2	3	3	3	2

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">STATISTICS WITH EXCEL PROGRAMMING (THEORY PAPER)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">SKILL ENHANCEMENT COURSE SEC-04</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">1</td><td rowspan="2">Course Code</td><td rowspan="2">23UMASE04</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">1</td><td colspan="2">--</td><td>--</td><td>1</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To Acquire the knowledge of Statistics with Excel Programming</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Distribution of data- Characteristics of data- Frequency distribution- Procedure for Constructing a Frequency Distribution-Using Excel to Construct a Frequency Distribution-Relative Frequency Distribution-Cumulative Frequency Distribution. (Chpater-2: Pages 58 to 70)</td></tr>
<tr><td colspan="6">UNIT-II: Histograms-Relative Frequency Histogram-Normal Distribution-Common Distribution Shapes-Skewness-Using XLSTAT for Histograms-Graphs-Using Excel to Construct a Scatterplot-Correlation Coefficient. (Chapter-2: Pages 70 to 81)</td></tr>
<tr><td colspan="6">UNIT-III: Time-Series Graph-Dotplots-Using XLSTAT for Stemplots-Bar Graphs-Using Excel to Create Bar Graphs-Pareto Charts-Pie Charts-Using Excel to Create Pie Charts-Frequency Polygon-Using Excel to Create Frequency Polygons. (Chapter-2: Pages 81 to 98)</td></tr>
<tr><td colspan="6">UNIT-IV: Descriptive statistics-Measures of Center-Mean-Using Excel to Calculate the Mean-Median-Using Excel to Find the Median. (Chapter-3: Pages 110 to 114)</td></tr>
<tr><td colspan="6">UNIT-V: Mode-Using Excel to Find the Mode-Midrange-Using Excel to Calculate the Midrange-Weighted Mean-Using Excel for Descriptive Statistics. (Chapter-3: Pages 114 to 125)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication, Transferrable Skill and designing mathematical models towards solving mathematical applications</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Mario F. Triola,“Elementary Statistics Using Excel”,Fifth Edition,Pearson New International Edition, 2014. (Chapter 2 and 3).</td></tr>
</table>

Reference Books	1. E. Balagurusamy, "Computer Oriented Statistical and Numerical Methods", Macmillan Publishers India Limited, 2000. 2. V. K. Rohatgi, A. M. E. Saleh, "An introduction to probability and statistics", John Wiley & Sons, 2015. 3. B. Held, B. Moriarty&T. Richardson, "Microsoft Excel Functions andFormulas", Stylus Publishing, LLC, 2019. 4. N. J. Salkind, "Excel statistics: A quick guide", Sage Publications, 2015. 5. J. Schmuller, "Statistical analysis with Excel for dummies", John wiley & sons, 2013.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1 : Handle distribution of data and analyses the characteristics of data using Excel.

CLO 2 : To find Normal distribution, common distribution shapes, Correlation Coefficient and plot graphs using Excel.

CLO 3 : Create Time-Series Graphs, Dotplots, Stemplots, Bar Charts, Pie Charts using Excel.

CLO 4 : Compute Mean and Median using Excel.

CLO 5 : Compute Mode, Midrange, Weighted Mean using Excel.

Title of the Course		**MATHEMATICS FOR COMPETITIVE EXAMINATION – III**					
Paper Number		**SKILL ENHANCEMENT COURSE SEC- 05**					
Category	**SEC**	**Year**	**II**	**Credits**	2	**Course Code**	**23UMASE05**
		Semester	III				
Instructional Hours Per week		**Lecture**	**Tutorial**		**Lab Practice**		**Total**
		2	-		-		2
Pre- requisite		12^{th} Standard Mathematics					
Objective of the Course		• Remembering the concept of Logarithms. • Understanding the concept of Simple Interest – Compound Interest. • Analyzing the concepts of Stocks and Shares.					
Course Outline		**UNIT – I** Simple Interest – Compound Interest.(Chap – 21 & 22)					
		UNIT – II Logarithms - Area.(Chap – 23 & 24)					
		UNIT – III Volume & Surface Areas – Races & Games of Skill. (Chap – 25 & 26)					
		UNIT – IV Calendar - Clocks.(Chap – 27 & 28)					
		UNIT – V Stocks & Shares.(Chap – 29)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.					
Recommended Text		1. R.S. Aggarwal, Quantitative Aptitude for Competitative Examinations, S.Chand co Ltd., 152. Anna Salai, Chennai,2010					
Reference Books		1. Quantitative Aptitude _'by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005)					
Website and e – Learning Source		https://nptel.ac.in					

Question Paper Pattern: 75 Objective type questions each carrying 1 Mark.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1 : Explain in detail about Simple Interest and Compound Interest.

CLO 2 : Explain Logarithms and Area.

CLO 3 : Explain Volume & Surface Areas and Races & Games of Skill.

CLO 4 : Explain Calendar and Clocks.

CLO 5 : Explain Stocks & Shares.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	1	-	-	3	2	1
CLO3	3	1	3	1	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	-	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">MATHEMATICS FOR COMPETITIVE EXAMINATION – IV</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">SKILL ENHANCEMENT COURSE SEC- 06</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td>Credits</td><td>2</td><td>Course Code</td><td>23UMASE06</td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours Per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td>2</td><td colspan="2">-</td><td colspan="2"></td><td>2</td></tr>
<tr><td colspan="2">Pre- requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objective of the Course</td><td colspan="7">• Remembering the Permutation and Combinations.
• Understanding the concept of Banker‘s Discount.
• Analysing the concepts of Odd Man Out and Series.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT – I
Permutation & Combinations.
(Chapter – 30)</td></tr>
<tr><td colspan="7">UNIT – II
Probability – True Discount.
(Chapter – 31 & 32)</td></tr>
<tr><td colspan="7">UNIT – III
Banker‘s Discount - Heights & Distances.
(Chapter – 33 & 34)</td></tr>
<tr><td colspan="7">UNIT – IV
Odd Man Out & Series.
(Chapter – 35)</td></tr>
<tr><td colspan="7">UNIT – V
Tabulation – Bar Graphs.
(Chapter – 36 & 37)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="7">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="7">1.Quantitative Aptitude _‘by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005)</td></tr>
<tr><td colspan="2">Website and e – Learning Source</td><td colspan="7">https://nptel.ac.in</td></tr>
</table>

Question Paper Pattern: 75 Objective type questions each carrying 1 Mark.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1 : Explain in detail about Permutation and Combinations.

CLO 2 : Explain Probability and True Discount.

CLO 3 : Explain Banker‘s Discount and Heights & Distances.

CLO 4 : Explain Odd Man Out and Series.

CLO 5 : Explain Tabulation and Bar Graphs.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	1	-	-	3	2	1
CLO3	3	1	3	1	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	-	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">LaTeX-PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">SKILL ENHANCEMENT COURSE SEC-07</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UMASE07</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td>2</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To enable the Students to Prepare Research Articles in LaTeX format.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">1. Creation of a Document with different Alignments (Left, Right, Centre, Justify).
2. Typing a Letter for Appling a job.
3. Creation of Own Bio-Data.
4. Creating a Table Structure.
5. Typing a Mathematical Expression involving Differentiation, Integration and Trigonometry.
6. Typing a Mathematical Expression using all Expressions and Inequalities.
7. Creation of an Article using LaTeX.
8. Inserting Picture in a LaTeX.
9. Preparing a question paper in LaTeX Format.
10. Creation of Power Point Presentation in LaTeX.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

Recommended Text	1. David F Griffiths and Desmond J. Higham, ***Learning LaTex,*** SIAM(Society for Industrial and Applied Mathematics) Publishers, Phidelphia, 1996.
Reference Books	1. Nambudiripad, K.B.M., 2014. ***LaTeX for beginners.*** Narosa Publishing House private limited, New Delhi. 2. Martin J. Erickson and Donald Bindner, ***A student's Guide to the Study, Practice and Tools of Modern Mathematics,*** CRC Press, Boca Raton, FL, 2011. 3. L. Lamport, ***LATEX: A Document Preparation System, User's Guide and Reference Manual,*** Addison-Wesley, Newyork, Second edition, 1994.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome

After completion of the course, the students will be able to

CLO 1 : Make different Alignments in a document and an Application for a job

CLO 2 : Generate Bio-Data and Table Structures.

CLO 3 : Create Mathematical Statements using LaTeX.

CLO 4 : Prepare Articles and Inserting Pictures.

CLO 5 : Prepare Question paper and PowerPoint presentation in LaTeX format.

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">STATISTICS WITH R PROGRAMMING (THEORY PAPER)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">PROFESSIONAL COMPETENCY SKILL PCS01</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">PCS</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UMAPC01</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
2</td><td colspan="2">Tutorial
--</td><td>Lab Practice
--</td><td>Total
2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To acquire the practical knowledge of R programming for solving problems in mathematical statistics.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Introduction to R Software: How to Download and Install R-Using R for Descriptive Statistical Analysis and Plots-Basics of R-R Data Types-Scalars-Vectors-Matrices-Data Frames. (Chapter-2 : Section 2.1 to 2.3.2.4)</td></tr>
<tr><td colspan="6">UNIT-II: Lists-Factors-Date and Time-Missing Values-Data Creation-Data Type Conversion-Variable Information. (Chapter-2: Section 2.3.2.5 to 2.3.6)</td></tr>
<tr><td colspan="6">UNIT-III: Basic Operations in R-Control Structures-Conditional - For Loop-Repeat Loop- While Loop-Built-In Functions in R-Numerical Functions-Character Functions-Statistical Probability Functions-Other Statistical Functions-Other Useful Functions-User-Written Functions. (Chapter-2: Section 2.4 to 2.4.4)</td></tr>
<tr><td colspan="6">UNIT-IV: Importing, Reporting, and Writing Data-Packages-Working Directory and R Script-Reading and Writing Local Flat Files-Reading and Writing Excel Files-Connection Interfaces-Connect to a Database- Data Exploration -Data Exploration through Visualization-Bar Chart-Pie Chart-Box-Plot Distributions. (Chapter-2: Section 2.4.4 to 2.5.1.3)</td></tr>
<tr><td colspan="6">UNIT-V: Descriptive Statistics: Central Tendency-The Mean-The Median-The Mode-Measure of Dispersion-Shapes of the Distribution-Symmetric and Asymmetric- Skewness Illustrated. (Chapter- 3: Section 3.1 to 3.3)</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Mustapha Abiodun Akinkunmi, "Business Statistics withSolutions in R" deGruyter-Berlin, 2019.
Reference Books	1. Peter Dalgaard, "Introductory Statistics with R" Second Edition, Springer, 2008. 2. Yosef Cohen, Jeremiah Y. Cohen, "Statistics and data with R"John Wiley & Sons Ltd. 2008.
Website and e-Learning Source	https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CLO 1 : Understand the usage of R Software and able to handle basic data types of R.

CLO 2 : Create data, find the missing values, converting data types.

CLO 3 : Apply the control structures, numerical and statistical functions.

CLO 4 : To import files, able to connect with a data base and handle Pie and Bar Charts.

CLO 5 : Compute mean, median, mode and skewness using R.

ELECTIVE SUBJECTS

GROUP-I

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">NUMERICAL METHODS WITH APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE COURSE ME01</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC (Discipline-centric)</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMAME01</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">--</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Numerical methods is a mathematical tool designed to solve numerical problems.
• It is the study of numerical methods that attempt at finding approximate solutions of problems rather than the exact ones.
• Apply Numerical differentiation and Numerical integration.</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="6">UNIT-I: The Bisection Method - The Iteration method - The method of false position - Newton Raphson Method - Generalized Newton's Method - Ramanujan's Method - Muller's method.
(Chapter 2: Sections 2.1 to 2.7)</td></tr>
<tr><td colspan="6">UNIT-II: Finite Difference - Forward Differences -Backward Differences - Central Differences - symbolic relations and separation of symbols - Newton's formulae for interpolation - Central Differences interpolation formulae - Gauss Central difference formulae - Stirling Formulae - Bessel's Formulae - Everett's formulae (Problems only).
(Chapter 3: Sections 3.3(3.3.1 - 3.3.4), 3.6, 3.7(3.7.1 - 3.7.4))</td></tr>
<tr><td colspan="6">UNIT-III : Lagrange's Interpolation Formulae - Divided differences - Divided differences table - Newton's Divided Difference formulae - Inverse Interpolation. (Problems only)
(Chapter 3: Sections 3.9.1, 3.11.1, 3.12)</td></tr>
</table>

	UNIT - IV: Numerical Differences - Maximum and minimum values of Tabulated function - Numerical Integration - Trapezoidal Rule - Simphson 1/3 Rule - Simphson 3/8 Rule - Boole's and Weddle's rule. (Problems only) (Chapter 5: Sections 5.2, 5.3, 5.4(5.4.1 - 5.4.4))
	UNIT-V: Direct method - Gauss elimination Method - Gauss Jordan Method - Modification of Gauss Method to compute the inverse - Method of Factorization - Iterative Methods -Gauss Jacobi method - Gauss seidel Method. (Problems only) (Chapter 6: Sections 6.3(6.3.2 - 6.3.4), 6.4)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability.
Recommended Text	1. S.S. Sastry - Introductory methods of numerical Analysis 3rd Edition, Prentice Hall of India Private Ltd., New Delhi.
Reference Books	1. P. Kandasamy, K. Thilagavathy, K. Gunavathy - Numerical Methods, Third Revised Edition, S.Chand & Company Ltd., Ram Nagar, New Delhi.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will able to

CLO 1: Find the roots of a polynomial equation. Find one of the most commonly used techniques for finding the roots of given equations.

CLO 2: Define for solving differential equations by approximating derivatives with finite differences. To solve the problems using forward and backward formulae.

CLO 3: To determine the functions values even when the parameters are not evenly spaces. In this chapter is used to calculate the values of the independent variable X that corresponds to a given function values.

CLO 4: To find involves the computation of a derivative of a function f from given values of f. To find how to use the Simphson 1/3 and 3/8 formulae for solving the problems.

CLO 5: To find techniques that attempt to find the exact or approximation solutions of non linear systems by applying a finite number of operations, such as matrix factorization, elimination, or inversion.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	2	1	1	3	3	2
CLO2	3	2	3	2	1	1	3	3	2
CLO3	3	2	3	2	1	1	3	3	2
CLO4	3	2	3	2	1	1	3	3	2
CLO5	3	2	3	2	1	1	3	3	2

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">NUMBER THEORY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE COURSE ME02</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC(Discipline-centric)</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2">23UMAME02</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="5"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">-</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics.</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To study the divisibility, primes, congruence‘s and arithmetic functions in number theory.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Divisibility
Introduction- Divisibility, Greatest Common Divisor, Euclid‘s Algorithm, Greatest Common Divisor via Euclid‘s Algorithm- Least Common Multiple- Representation of Integers, Decimal Representation of Integers, Binary Representation of Integers(Chapter:2. Sections 2.1 to 2.4, Related Problems)</td></tr>
<tr><td colspan="8">UNIT-II: Primes
Introduction-Primes, Prime counting function, prime number theorem, Test of primality by trial division – Sieve of Eratothenes, Canonical Factorization, Fundamental theorem of arithmetic, Sieve of Eratothenes, Determining the canonical factorization of a natural number (Chapter3:. Sections-3.1 to 3.3, Related Problems)</td></tr>
<tr><td colspan="8">UNIT-III: Congruences
Introduction-Congruences and Equivalence Relations, Equivalence Relations and Linear Congruences - Linear Diophantine Equations and the Chinese Remainder Theorem (Chapter4: Sections 4.1 to 4.4, Related Problems)</td></tr>
<tr><td colspan="8">UNIT-IV: Congruences(continued)
Polynomial Congruences- Modular Arithmetic: Fermat‘s theorem – Wilson‘s Theorem and Fermat‘s Numbers – Pythagorean Equation(Chapter4: Sections 4.5 to 4.8, Related Problems)</td></tr>
<tr><td colspan="8">UNIT-V: Arithmetic Functions
Introduction- Sigma function, Tau function, Dirichlet product – Dirichlet Inverse, Moebius function, Euler‘s function, Euler‘s Theorem, An application of algebra (Chapter5: Sections 5.1 to 5.3, Related Problems)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication, Transferrable Skill and mathematical applications</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">1. Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi2006.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8">1. David M. Burton, Elementary Number theory 6th Ed., Tata McGraw – Hill Edition, 2007.
2. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, Applications of Abstract Algebra with Maple, CRC Press, Boca Raton, 2000.</td></tr>
</table>

Website and e-Learning Source	https://nptel.ac.in

Title of the Course	**MATHEMATICAL STATISTICS**

Course Learning Outcome (for Mapping with POs and PSOs)

On successful completion of the course, the students will be able to

CLO 1: Describe Euclid‘s Algorithm, Greatest Common Divisor via Euclid‘s Algorithm.

CLO 2: To discuss The Fundamental Theorem of arithmetic, the sieve of Eratesthenes.

CLO 3: To describe Euclid‘s Algorithm, Greatest Common Divisor via Euclid‘s Algorithm**.**

CLO 4: Discuss Linear Diophantine Equations and the Chinese Remainder Theorem**.**

CLO 5: Discuss Euler‘s Theorem, An application of algebra.

Mapping of COs with POs

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	2	3	2	3	3	3	2	3	2
CLO2	2	2	3	3	3	3	2	3	2
CLO3	3	3	2	3	3	3	2	3	2
CLO4	2	3	3	3	3	2	2	3	2
CLO5	3	3	3	2	3	2	2	3	2

<table>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE COURSE ME03</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC(Discipline-centric)</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMAME03</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2"></td><td>5</td><td>-</td><td>--</td><td colspan="3">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To Introduce the concepts of Random Variables and Distribution of Random Variables.
• To give a good grip on concepts of Mathematical Expectation and Variance.
• To provide a sound knowledge about some Standard Distributions.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I :
Random variables and Distribution functions:
Introduction– Distribution functions - Discrete random variable (One dimensional)- Probability mass function and Distribution function – Continuous Random variable (one dimensional) –Probability density function – Various Measures of Central tendency-Continuous distribution function-Problems. (Chapter5: Sections 5.1 to 5.4)</td></tr>
<tr><td colspan="6">Unit II:
Mathematical Expectation:
Introduction –Mathematical Expectation –Expected value of function of Random variable- Properties - Variance – Properties – Covariance. (Chapter6: Sections 6.1 to 6.6)</td></tr>
<tr><td colspan="6">Unit III:
Generating functions and Law of large numbers:
Moment Generating functions – Cumulants - Characteristic function – Properties – Problems . (Chapter7: Sections 7.1 to 7.4)</td></tr>
<tr><td colspan="6">Unit IV:
Special Discrete Probability Distributions:
Introduction - Binomial, Poisson, Geometric distributions– Theorems (Statements only)- Properties and Problems. (Chapter8: Sections 8.1, 8.4, 8.5, 8.7.)</td></tr>
<tr><td colspan="6">Unit V:
Some Continuous Probability Distributions:
Normal distribution, Uniform distribution and Exponential distribution - Theorems (Statements only) -Properties and Problems. (Chapter9: Sections 9.1 to 9.3, 9.8)</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
Skills acquired from this course	Knowledge, problem solving, analytical ability, and professional competency.
Recommended Text	1. Gupta S.C. and Kapoor V.K. Fundamentals of Mathematical Statisti [Twelfth Edition]. Sulthan Chand and Sons, New Delhi 2020.
Reference Books	1. Gupta S.C. and Kapoor V.K. Elements of Mathematical Statistics. [Third Edition]. Sulthan Chand and Sons, New Delhi.2001 2. Vittal, P.R. Mathematical Statistics. Margham Publications, Chennai.2020.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Define Random variables, Probability mass function, Probability density function, and Distribution functions.

CLO 2: Compute Expectation, Variance and Covariance.

CLO 3: Know about Moment Generating functions and Characteristic functions.

CLO 4: Solve problems involving the concepts of theoretical Discrete distributions.

CLO 5: Solve problems involving the concepts of theoretical continuous distributions.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	2	3	1	3	3	2

CLO2	3	2	3	2	3	1	3	3	2
CLO3	3	2	3	2	2	1	3	3	2
CLO4	3	2	3	2	2	1	3	3	2
CLO5	3	2	3	2	2	1	3	3	2

ELECTIVE SUBJECTS

GROUP-II

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DIFFERENCE EQUATIONS WITH APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE COURSE ME04</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC(Discipline-centric)</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UMAME04</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">--</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• It is the study of difference operator and its application.
• Solving first order difference equations.
• Solving Difference equations using matrix form.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Difference operator - Summation - Generating functions and approximate summation.
(Chapter 2: Sections 2.1 to 2.3)</td></tr>
<tr><td colspan="6">UNIT-II: First order equations - General results for linear equations - Solving linear equations.
(Chapter 3: Sections 3.1 to 3.3)</td></tr>
<tr><td colspan="6">UNIT-III: Equations with variable coefficients - The z - transform.
(Chapter 3: Sections 3.5 to 3.7)</td></tr>
<tr><td colspan="6">UNIT-IV: Initial value problems for linear systems - Stability of linear systems.
(Chapter 4: Sections 4.1, 4.2)</td></tr>
<tr><td colspan="6">UNIT-V: Phase plane Analysis for Linear Systems, Fundamental Matrices and Floquet Theory.
(Chapter 4: Sections 4.3, 4.4)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving.</td></tr>
</table>

Recommended Text	1**. W.G. Kelley** and **A.C. Peterson,** *"Difference Equations"*, 2nd Edition, Academic Press, New York, 2001.
Reference Books	1. **R.P. Agarwal**, *"Difference Equations and Inequalities***",** 2nd Edition, Marcel Dekker, New York, 2000. 2. **S.N. Elaydi, "***An Introduction to Difference Equations***",** 3rd Edition, Springer, India, 2008. 3. **R. E. Mickens**, *"Difference Equations***",** 3rd Edition, CRC Press, 2015.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will able to

CLO 1: How to use difference operator.

CLO 2: Solving first order difference equation and linear equations.

CLO 3: To Solve equation with variable coefficients.

CLO 4: To solve the initial value problem for linear systems.

CLO 5: To solve the fundamental matrices.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	2	1	1	3	3	2
CLO2	3	2	3	2	1	1	3	3	2
CLO3	3	2	3	2	1	1	3	3	2
CLO4	3	2	3	2	1	1	3	3	2
CLO5	3	2	3	2	1	1	3	3	2

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">DISCRETE MATHEMATICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE COURSE ME05</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC(Discipline-centric)</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMAME05</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">--</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Mathematical Logic
• Truth Table
• Relations and Ordering</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="8">UNIT-I: Mathematical logic - Statements and Notations - Connectives - Negation - Conjunction - Disjunction - Statement formulas and truth table - Conditional and Bi-conditional - Well formed formulas - Tautologies.
Chapter 1(sections 1.1, 1.2.1 to 1.2.4, 1.2.6 to 1.2.8)</td></tr>
<tr><td colspan="8">UNIT-II: Normal forms - Disjunctive Normal forms - Conjunctive Normal forms - Principal Disjunctive Normal forms - Principal conjunctive Normal forms - Ordering and Uniqueness of normal forms - Validity using truth tables - Rules of inference.
Chapter 1 (sections 1.3.1 to 1.3.5, 1.4.1, 1.4.2)</td></tr>
<tr><td colspan="8">UNIT-III: The Predicate calculus - Predicates - The Statement function, Variables and quantifiers - Predicate formulas - Free and bound variables - The Universe of discourse - inference theory of the predicate calculus - Valid formulas and Equivalence - Some valid formulas over finite Universes - Special valid formulas involving quantifiers - Theory of inference for the Predicate calculus.
Chapter 1 (sections 1.5.1 to 1.5.5)</td></tr>
<tr><td colspan="8">UNIT - IV: Relations and Ordering - Relations - Properties of Binary relations in a set - Partial ordering - Partially ordered set: Representation and Associated terminology - Functions: Definition and Introduction - Composition of functions - Inverse functions - Natural Numbers: Peano axioms and Mathematical induction.
Chapter 2 (sections 2.3.1, 2.3.2, 2.3.8, 2.3.9, 2.4.1 to 2.4.3, 2.5.1)</td></tr>
</table>

	UNIT-V: Lattices as partially ordered sets: Definition and examples - Some properties of Lattices - Sub lattices, Direct product and Homomorphism - Boolean algebra: Definition and examples - Sub Algebra, Direct product and Homomorphism. Chapter 4 (sections 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2)
Skills acquired from this course	Knowledge, Problem Solving.
Recommended Text	1. J.P. Tremblay, R. Manohar, Discrete Mathematics structure with Applications to computer sciences, Tata Mc Graw hill, 2001.
Reference Books	1. Dr. M.K. Sen and Dr. B.C. Charraborthy, Introduction to Discrete Mathematics, Arunabha Sen Books & allied Pvt. Ltd, 8/1, Chintamoni Das Lane, Kolkatta - 700 009. 2. Kenneth H.Rosen, Discrete Mathematics and Its Applications, Fourth Edition.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will able to

CLO 1: To find mathematical logic statement and notations.

CLO 2: To find the decision problem of finding whether a given statement is tatutology or contradiction or satisfiable in a finite number of steps.

CLO 3: To find the predicate logic. To find the theory of inference for the Predicate calculus.

CLO 4: Define Relations and Ordering. Define types of functions and natural numbers.

CLO 5: Define Definition and properties of Lattice. To solve Boolean Algebra.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	2	1	1	3	3	2
CLO2	3	2	3	2	1	1	3	3	2
CLO3	3	2	3	2	1	1	3	3	2
CLO4	3	2	3	2	1	1	3	3	2
CLO5	3	2	3	2	1	1	3	3	2

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">GRAPH THEORY WITH APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE COURSE ME06</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC(Discipline-centric)</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UMAME06</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">-</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• To introduce the concepts of Graphs.
• To provide a sound knowledge on Trees and Spanning Trees
• To gain knowledge about Matrices of Graphs and Digraphs.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="7">Unit I :
Introduction, Paths and Circuits:
Introduction- Finite and Infinite graphs-Applications of Graphs-Incidence and degree-Isolated vertex, Pendent vertex and Null graph-Isomorphism- Subgraphs -Walks, Paths and circuits-Connected Graphs-Disconnected Graphs and Components.
(Chapter1: Sections 1.1 to 1.5 & Chapter2: Sections 2.1,2.2, 2.4&2.5)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit II:
Paths and Circuits:
Euler graphs- Operations on Graphs-More on Euler graphs-Hamiltonian Paths and Circuits
Trees and Fundamental Circuits:
Trees-Some properties on Trees-Pendent vertices in a Tree-Distance and Canters in a Tree- Spanning Trees.
(Chapter2: Sections 2.6 to 2.9 & Chapter3: Sections 3.1 to 3.4, 3.7)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit III:
Matrix Representation of Graphs:
Incidence Matrix- Submatrices of A(G)-Circuit Matrix-Fundamental Circuit Matrix and Rank of B- Path Matrix-Adjacency Matrix.
(Chapter7: Sections 7.1 to 7.9)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit IV:
Colouring, Covering and Partitioning:
Chromatic Number-Chromatic Partitioning-Chromatic Polynomial-Matchings –Coverings.
(Chapter8: Sections 8.1 to 8.5)</td></tr>
</table>

	Unit V: **Directed Graphs:** Definition-Some types of Digraphs-Directed Paths and Connectedness-Euler Digraphs-Trees with Directed Edges. (Chapter9: Sections 9.1, 9.4 to 9.6)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
Skills acquired from this course	Knowledge, problem solving, analytical ability, and professional competency.
Recommended Text	1. Narsingh Deo. [Fifth Edition] ,Graph Theory with Applications to Engineering &Computer Science , Prentice Hall of India, New Delhi . 1974 .
Reference Books	1. Frank Harary. Graph Theory , Narosa Publishing House, Pvt.Ltd., New Delhi. 2001. 2. Arumugam, S. and Ramachandran, S. Invitation to Graph Theory. Scitech Publications, Chennai.2001. 3. S.P.Rajagopalan and R.Sattanatthan,Graph Theory, Margham Publications, Chennai.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Understand the concepts of Graph, Sub graph , Walks and Paths.
CLO 2: Discuss about Eulerian graphs, Hamiltonian Paths and Trees.

CLO 3: Give Matrix Representations of Graphs

CLO 4: Know about Chromatic number and Chromatic Polynomial
CLO 5: Describe about digraph, Euler digraphs.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	2	2	1	3	3	2
CLO2	3	2	3	2	2	1	3	3	2
CLO3	3	2	3	2	2	1	3	3	2
CLO4	3	2	3	2	2	1	3	3	2
CLO5	3	2	3	2	2	1	3	3	2

ELECTIVE/ALLIED MATHEMATICS

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">ALLIED MATHEMATICS-I: ALGEBRA AND CALCULUS (FOR B. Sc PHYSICS / B. Sc CHEMISTRY/ B. Sc STATISTICS/ B. Sc ELECTRONICS & COMMUNICATIONS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ALLIED MATHEMATICS-I AT01</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE/ ALLIED</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23UMAAT01</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>6</td><td>--</td><td></td><td colspan="3">6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To learn the basic concepts and problem solving in Theory of equations.
• Develop the ability of solving the Integrals.</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="6">UNIT – I : Theory of Equations :
Imaginary roots – Irrational roots – Formation of equations – Solutions of equations – Diminishing the roots of an equation & solutions – Removal of the second term of an equation & solutions – Descarte‘s rule of sign – Problems only. (Chapter6: Sections 4,9,10 & 11)</td></tr>
<tr><td colspan="6">UNIT – II: Matrices:
Definition of Characteristic equation of a matrix –Characteristic roots of a matrix - Eigen values and the Corresponding Eigen vectors of matrix – Cayley Hamilton theorem (Statement only) – Verifications of Cayley Hamilton Theorem – Problems only. (Chapter 5)</td></tr>
<tr><td colspan="6">UNIT – III : Radius of Curvature:
Formula of Radius of Curvature in Cartesian coordinates, Parametric coordinates and Polar coordinates (no proof for formulae) – Problems only. (Chapter11)</td></tr>
<tr><td colspan="6">UNIT – IV : Partial Differential Equations
Formation of Partial Differential Equations by eliminating the arbitrary constant and arbitrary functions – Lagrange‘s Linear Partial Differential Equations – Problems only. (Chapter26)</td></tr>
</table>

	UNIT – V : Integration: Definite Integral : Simple properties of definite Integrals(Chap -15) – Bernoulli's Formula – Integration by parts – Simple problems ; Reduction formula for $\int_0^{\frac{\pi}{2}} sin^n x\ dx$, $\int_0^{\frac{\pi}{2}} cos^n x\ dx$, $\int_0^{\infty} e^{-x}\ dx$, $\int x^n e^{ax}\ dx$ simple problems. (Chapter16)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Dr. P.R. Vittal, Allied Mathematics , Margham publication, Chennai – 17, Reprint 2016
Reference Books	1. S.G Venkatachalapathi, Allied Mathematics, Margham publication, Chennai – 17, Reprint 2011 2. P. Kandasamy, K.Thilagavathy, Allied Mathematics Volume I, S.Chand publication, July 2012 3. P. Kandasamy, K.Thilagavathy Allied Mathematics Volume II, S.Chand publication, December 2010
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with Pos and PSOs)

Students will be able to

CLO 1 : Explain in detail about Imaginary roots, irrational roots and formation of equations and Descarte's rule of sign.

CLO 2 : Explain Characteristic equation and roots of the matrix and Eigen values and Eigen vector of the matrix and Verification of Cayley Hamilton theorem.

CLO 3 : Explain Formula for Radius of curvature in Cartesian coordinates and Parametric coordinates and Polar coordinates

CLO 4 : Explain Formation of Partial Differential Equations by eliminating the arbitrary constant and arbitrary functions

CLO 5 : Explain Simple properties of definite Integrals and Bernoulli's Formula and Integration by parts.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	1	-	-	3	2	1
CLO3	3	1	3	1	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	-	-	3	2	1

Title of the Course		**ALLIED MATHEMATICS-II: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS (FOR B. Sc PHYSICS /B. Sc CHEMISTRY/ B. Sc STATISTICS/ B. Sc ELECTRONICS & COMMUNICATIONS)**					
Paper Number		**ALLIED MATHEMATICS-II AT02**					
Category	ELECTIVE/ ALLIED	**Year**	I	**Credits**	4	**Course Code**	**23UMAAT02**
		Semester	II				
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**		
		4	--		4		
Pre-requisite		12^{th} Standard Mathematics					
Objectives of the Course		• Develop the basic concepts of Maxima and Minima of two variables and Numerical methods problems. • To learn the second order differential equation with constant coefficients. • To learn the basic concepts of Laplace Transforms, Inverse Laplace Transforms &Applications.					
Course Outline		**UNIT – I : Jacobian and Maxima & minima :** Jacobian of two variables and three variables – Maxima and Minima functions of two variables – Problems only. (Chapter9: Sections 3 & 4)					
		UNIT – II: Finite Differences: Finite difference – Higher differences – Construction of difference table – Interpolation of missing value – Newton‘s Forward and Newton‘s Backward difference formula (no proof) – Lagrange‘s Interpolation formula (no proof) - simple problems only. (Chapter7)					

	UNIT – III : Second Order Differential Equations: Second Order Differential Equation with constant coefficients – Complementary function – Particular Integral and Solution of the type :e^{ax}, x^n , cos ax (or) sin ax ,$e^{as}x^{bs}$,e^{as}sin bx, e^{as}cos bx – Problems only. (Chapter23)
	UNIT – IV : Laplace Transforms: Definition of Laplace Transforms – Standard formula – Linearity property – shifting property – Change of Scale property – Laplace Transforms of derivatives – Problems. (Chapter27)
	UNIT – V : Inverse Laplace Transforms : Standard formula- Elementary theorems (no proof) – Applications to solutions of second order differential equations with constant coefficients – simple problems. (Chapter27)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Dr.P.R. Vittal, Allied Mathematics , Margham publication, Chennai – 17, Reprint 2016
Reference Books	1. S.G Venkatachalapathi, Allied Mathematics, Margham publication, Chennai – 17, Reprint 2011 2. P. Kandasamy, K.Thilagavathy Allied Mathematics Volume I, S.Chand publication, July2012 3. P. Kandasamy, K.Thilagavathy Allied Mathematics Volume II, S.Chand publication, December 2010
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1 : Explain Jacobian of two variables and three variables and Maxima and Minima functions of two variables.

CLO 2 : Explain Finite difference and Higher differences and Construction of difference table and Newton‘s Forward Backward difference formula and Lagrange‘s Interpolation formula.

CLO 3 : Explain Second Order Differential Equation with constant coefficients and Particular Integral

CLO 4 : Explain definition of Laplace Transforms and standard formula and linearity property and shifting property and Change of Scale property and Laplace Transforms of derivatives.

CLO 5 : Explain standard formula and elementary theorems and Applications to solutions of second order differential equations with constant coefficients.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	1	-	-	3	2	1
CLO3	3	1	3	1	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	-	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">ALLIED MATHEMATICS – PRACTICAL
(FOR B. Sc PHYSICS /B. Sc CHEMISTRY/ B. Sc STATISTICS/ B. Sc ELECTRONICS & COMMUNICATIONS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ALLIED MATHEMATICS PRACTICAL AP01</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE/ ALLIED</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UMAAP01</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">--</td><td>--</td><td colspan="2">2</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Acquire knowledge about Matrices and Cayley – Hamilton Theorem.
• Understand the concepts of differentiation and Vector point function.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT I: Matrices:
Rank of Matrix – Problems up to (3x3) Matrix – Characteristics equation of a Matrix – Cayley Hamilton Theorem (statement only) – Problems to verify Cayley Hamilton Theorem. (Chapter5)</td></tr>
<tr><td colspan="6">UNIT II : Leibnitz formula for nth derivative :
Leibnitz formula (without proof) for nth derivative – Problems. (Page no: 8.23 to 8.39 of the Text book)(Chapter8)</td></tr>
<tr><td colspan="6">UNIT III : Partial Differentiation :
Euler _s theorem on homogeneous function (without proof) – Problems to verify Euler‘s Theorem – Partial derivative – problems (Page no. 9.1 to 9.13 and 9.18 to 9.27 of the Text Book)(Chapter9)</td></tr>
<tr><td colspan="6">UNIT IV : Vector Differentiation :
Scalar and Vector point functions – Gradient of scalar point functions – Problems only. (Chapter28)</td></tr>
<tr><td colspan="6">UNIT V : Divergence and Curl of Vector point functions :
Divergence and Curl of vector point functions – Solinoidal vector – Irrotational vector – Problems only.(Chapter28)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Dr. P.R. Vittal, Allied Mathematics , Margham publication, Chennai – 17, Reprint 2016
Reference Books	1. S.G Venkatachalapathi, Allied Mathematics, Margham publication, Chennai – 17, Reprint 2011 2. P. Kandasamy, K.Thilagavathy Allied Mathematics Volume I, S.Chand publication, July2012. 3. P. Kandasamy, K.Thilagavathy Allied Mathematics Volume II, S.Chand publication, December 2010
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1 : Explain in detail about Rank of Matrix and Characteristics equation of a Matrix and Cayley Hamilton Theorem and Problems to verify Cayley Hamilton .

CLO 2 : Explain Leibnitz formula for n^{th} derivative.

CLO 3 : Explain Euler _s theorem on homogeneous function and Problems to verify Euler's Theorem and Partial derivative.

CLO 4 : Explain Scalar and Vector point functions and Gradient of scalar point functions.

CLO 5 : Explain Divergence and Curl of vector point functions and Solinoidal vector and Irrotational vector.

	POs					s	PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	1	-	-	3	2	1
CLO3	3	1	3	1	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	-	-	3	2	1

Title of the Course	DISCRETE MATHEMATICS – I (FOR ALL COMPUTER SCIENCE DEPARTMENTS)

<table>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE COURSE GENERIC SPECIFIC - EGS01</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">5@</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UMAEGS01</td></tr>
<tr><td>Semester</td><td>@</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">@</td><td colspan="2">-</td><td>@</td><td colspan="2">6@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• Mathematical Logic
• Truth Table
• Relations and Ordering</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT-I:
Mathematical Logic: Statement and Notation - Connectives – Negation – Conjunction – Disjunction-Statement Formulas and Truth Tables – Conditional and Biconditional – Well-formed Formulas – Tautologies
Chapter: 1 (Section: 1.1, 1.2(1.2.1 to 1.2.8)</td></tr>
<tr><td colspan="7">UNIT-II:
Normal Forms: Disjunctive Normal Forms – Conjunctive Normal Forms –Principal Disjunctive Normal Forms –Principal Conjunctive Normal Forms –Ordering and Uniqueness of Normal Forms- The theory of inference for the statement calculus: Validity Using Truth Tables -Rules of Inference – Consistency of Premises and Indirect Method of Proof.
Chapter-1 (section: 1.3, 1.3.1 to 1.3.5 & 1.4, 1.4.1 to 1.4.3)</td></tr>
<tr><td colspan="7">UNIT-III:
The Predicate Calculus: Predicates – The Statement Function, Variables, and Quantifiers – Predicate Formulas – Free and Bound Variables – The Universe of Discourse.
Inference theory of the predicate calculus: Valid Formulas and Equivalences – Some Valid Formulas Over Finite Universes – Special Valid Formulas Involving Quantifiers – Theory of Inference for the Predicate Calculus – Formulas Involving More Than One Quantifiers.
Chapter-1 (section: 1.5, 1.5.1 to 1.5.5 &1.6.1 to1.6.5)</td></tr>
<tr><td colspan="7">UNIT – IV:
Set Theory: Notation – Inclusion and Equality of Sets – The Power Set – Some Operations on Sets –Venn Diagrams – Some Basic Set Identities – The Principle of Specification – Ordered Pairs and n-tuples – Cartesian Products.
Chapter-2(section: 2.1.1 to 2.1.9)</td></tr>
<tr><td colspan="7">UNIT-V:
Relation and ordering: Relations – Properties of Binary Relations in a Set – Relation Matrix and the Graph of a Relation – Partition and Covering of a Set – Functions: Definition and Introduction – Composition of Function – Inverse Function – Binary and n-ary Operations – Characteristic Function of a Set – Hashing Functions-Peano Axioms and Mathematical Introduction – Cardinality.
Chapter- 2 (section: 2.3.1 to 2.3.4 & 2.4.1 to 2.5.2)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="7">Knowledge, Problem Solving.</td></tr>
</table>

Recommended Text	1. Discrete mathematics structures with application to computer science – J.P.Tremblay and R. Manohar
Reference Books	1. Discrete Mathematics – Dr.S.P.Rajagopalan and Dr.R.Sattanathan 2. Discrete Mathematics – Dr.G.Balaji 3. Discrete Mathematics and its applications – Kenneth.H.Rosen.
Website and e-Learning Source	https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement
CO1	Define Mathematical Logics and few examples
CO2	Define Normal Forms and The theory of inference for the statement calculus
CO3	Describe The Predicate Calculus and Inference theory of the predicate calculus
CO4	Define Some Basic Set Identities, and Cartesian products
CO5	Describe Relation and ordering and Functions

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	3	2	3
CO5	2	3	3	3	3

@ Refer to Curriculum Page No – 16 .

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">DISCRETE MATHEMATICS - II
(FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE COURSE GENERIC SPECIFIC - EGS02</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">5@</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UMAEGS02</td></tr>
<tr><td>Semester</td><td>@</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">@</td><td colspan="2">-</td><td colspan="2">@</td><td>6@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Mathematical Logic
• Truth Table
• Relations and Ordering</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="8">UNIT-I:
Algebraic Systems: Examples and General Properties-Definition and Examples-Some Simple Algebraic Systems and General Properties.
Semigroups and Monoids: Definitions and Examples-Homomorphism of Semigroups and Monoids-Sub semigroups and Sub monoids
Grammars and languages: Discuss of Grammars-Formal definition of a Language-Notion of Syntax Analysis
(Chapter-3: Sections 3.1 to 3.3)</td></tr>
<tr><td colspan="8">UNIT-II:
Groups: Definitions and Examples-Subgroups and homomorphisms-Cosets and Language‘s Theorem-Normal Subgroups-Algebraic systems with Two Binary operations-The application of the residue arithmetic to computers: Introduction to number system-residue arithmetic.
(Chapter 3: Sections 3.5(3.5.1 - 3.6.2)</td></tr>
<tr><td colspan="8">UNIT-III: Latex and Boolean algebra
Lattices as partially ordered sets-definition and examples-some properties of lattices-lattices as algebraic system-sublattices, Direct product, and homomorphism-some special lattices -Boolean algebra-definition and examples-subalgebra, direct product, and homomorphism.
(Chapter 4: Sections 4.1.1 to 4.2.2)</td></tr>
<tr><td colspan="8">UNIT – IV: Boolean function-Boolean forms and free Boolean algebras-values of Boolean expressions and Boolean functions-Representation and minimization of Boolean functions: representation of Boolean functions-minimization of Boolean functions(Chapter 4: Sections 4.3.1 to 4.4.2)</td></tr>
</table>

	UNIT-V: Graph theory: Basic concepts of graph theory-basic definitions-paths, reachability and connectedness-matrix representation of graphs-trees-storage representation and manipulation of graphs-Trees: their representation and operations-List: structures and graphs (Chapter 5: Sections 5.1.1 to 5.2.2)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability.
Recommended Text	1. Discrete mathematics structures with application to computer science – J.P. Tremblay and R. Manohar
Reference Books	1. Discrete Mathematics – Dr.S.P. Rajagopalan and Dr.R. Sattanathan 2. Discrete Mathematics – Dr.G.Balaji 3. Discrete Mathematics and its applications – Kenneth.H.Rosen.
Website and e-Learning Source	https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement
CO1	Define Algebraic system - definitions and examples.
CO2	Define Groups and The application of the residue arithmetic to computers
CO3	Define Latex and Boolean algebra and problems
CO4	Define Boolean functions and examples
CO5	Define graph theory and some basic definitions

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	3	2	3
CO5	2	3	3	3	3

@ Refer to Curriculum Page No – 16.

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">NUMERICAL METHODS
(FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE COURSE GENERIC SPECIFIC – EGS03</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">5@</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UMAEGS03</td></tr>
<tr><td>Semester</td><td>@</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">@</td><td colspan="2">-</td><td colspan="2">@</td><td>6@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12Th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Numerical methods is a mathematical tool designed to solve numerical problems.
• It is the study of numerical methods that attempt at finding approximate solutions of problems rather than the exact ones.
• Apply Numerical differentiation and Numerical integration.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">UNIT-I: Solution of Algebraic
Introduction -The Bisection Method - The Iteration method – The method of false position - Newton Raphson Method -Generalized Newton's Method
(Chapter 2: Sections 2.1 to 2.5)</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-II: Interpolation with equal intervals
Finite Difference - Forward Differences -Backward Differences - Central Differences - symbolic relations and separation of symbols - Newton's formulae for interpolation - Central Differences interpolation formulae - Gauss Central difference formulae - Stirling Formulae
(Chapter 3: Sections 3.3(3.3.1 - 3.3.4), 3.6, 3.7(3.7.1 - 3.7.2))</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-III : Interpolation with unequal intervals
Lagrange's Interpolation Formulae - Divided differences - Divided differences table - Newton's Divided Difference formulae - Inverse Interpolation. (Problems only)
(Chapter 3: Sections 3.9.1, 3.11.1, 3.12)</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT – IV: Numerical Differentiation and Integration
Numerical Differences - Maximum and minimum values of Tabulated function - Numerical Integration - Trapezoidal Rule - Simphson 1/3 Rule - Simphson 3/8 Rule
(Chapter 5: Sections 5.2, 5.3, 5.4(5.4.1 - 5.4.3))</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-V: Solution of Simultaneous linear Algebraic equations
Direct method - Gauss elimination Method - Gauss Jordan Method - Modification of Gauss Method to compute the inverse - Method of Factorization - Iterative Methods -Gauss Jacobi method - Gauss seidel Method. (Problems only)
(Chapter 6: Sections 6.3(6.3.2 - 6.3.4), 6.4)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability.
Recommended Text	1. S.S. Sastry - Introductory methods of numerical Analysis3rd Edition, Prentice Hall of India Private Ltd., New Delhi.
Reference Books	1. P. Kandasamy, K. Thilagavathy, K. Gunavathy -Numerical Methods, Third Revised Edition, S.Chand&Companyy Ltd., Ram Nagar, New Delhi.
Website and e-Learning Source	https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement
CO1	Solve Algebraic methods and problems
CO2	Define Interpolation with equal intervals and problems
CO3	Define Interpolation with unequal intervals and problems
CO4	Define Numerical Differentiation and Integration, problems
CO5	Define Solution of Simultaneous linear Algebraic equations and problems

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	3	2	3
CO5	2	3	3	3	3

@ Refer to Curriculum Page No – 16 .

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">OPTIMIZATION TECHNIQUES
(FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE COURSE GENERIC SPECIFIC - EGS04</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td colspan="2">I/II</td><td rowspan="2">Credits</td><td rowspan="2">5@</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UMAEGS04</td></tr>
<tr><td>Semester</td><td colspan="2">@</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">@</td><td colspan="2">-</td><td colspan="2">@</td><td colspan="2">6@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• To know the concepts of Mathematical formulation and solving L.P.P
• To find the solutions of Transportation and Assignment models.
• To teach the techniques for converting the real life problems as Mathematical problems and solving them.</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="8">Unit I :
Linear Programming Formulation and Graphical Method: Introduction - Requirements for employing LPP technique - Mathematical Formulation of L.P.P. - Basic assumptions - Graphical method of the Solution of a L.P.P. - Some more cases - Advantage of Linear Programming - Limitations of Linear Programming.
Chapter 2 (Sections 2.1 - 2.8)</td></tr>
<tr><td colspan="8">Unit II:
Transportation Model: Introduction - Mathematical formulation of a transportation problem - Methods for finding initial basic feasible solution - Transportation algorithm or MODI method - Degeneracy in Transportation problems - Unbalanced Transportation Problems - Maximization case in Transportation problems.
Chapter 7 (Sections 7.1 - 7.5)
.</td></tr>
<tr><td colspan="8">Unit III:
Assignment Problem: Introduction - Mathematical formulation of an Assignment Problem -Difference between the Transportation Problem and Assignment Problem - Assignment Algorithm or Hungarian Method - Unbalanced Assignment Models - Maximization case in Assignment Problems.
Chapter 8 (Sections 8.1 - 8.2, 8.4 - 8.7)</td></tr>
</table>

	Unit IV: **Sequencing Problems:** Introduction – Assumptions of solving a sequencing Problem - Definition - Procedure for finding Optimum Sequence (n jobs on 2 machines) – Processing n jobs on three machines – Processing n jobs on m machines. Chapter 14 (Sections 14.1 – 14.6).
	Unit V: **Scheduling by PERT and CPM:** Introduction - Basic Terminologies - Rules for constructing a project network - Network computations - Floats - Programme Evaluation Review Technique (PERT) - Basic differences between PERT and CPM. Chapter 15 (Sections 15.1 - 15.7)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
Skills acquired from this course	Knowledge, problem solving, analytical ability, and professional competency.
Recommended Text	**1. Sundaresan,V., Ganapathy Subramanian, K.S. and Ganesan, K. Resource Management Techniques**. [Seventh Edition]. AR Publication, Chennai.2013
Reference Books	**1. Kantiswarup., Gupta, P.K. and Man Mohan. Operations Research.**[Seventeenth Edition]. Sultan Chand and Sons, New Delhi.2020. **2. Gupta, P.K. and Hira,D.S. OperationsResearch.** [Eighth Edition]. Sulthan Chand and Company, New Delhi .2020. **3. Kalavathy.S. Operations Research**[Fourth Edition],Vikas Publishing House,Chennai.2012.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Formulate and solve real life problems through L.P.P.

CLO 2: Compute the optimum Transportation schedule.

CLO 3: Find the optimum Assignment model.

CLO 4: Solve Sequencing problems.

CLO5 : Use the techniques for planning and scheduling of projects.

	POs						PSOs			
	1	2	3	4	5	6	1	2	3	4
CLO1	2	3	3	2	1	3	2	3	3	3
CLO2	2	3	3	2	1	3	2	3	3	3
CLO3	2	3	3	2	1	3	2	3	3	3
CLO4	2	3	3	2	1	3	2	3	3	3
CLO5	2	3	3	2	1	3	2	3	3	3

@ Refer to Curriculum Page No – 16 .

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">INTRODUCTION TO LINEAR ALGEBRA
(FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE COURSE GENERIC SPECIFIC – EGS05</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">5@</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UMAEGS05</td></tr>
<tr><td>Semester</td><td>@</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">@</td><td colspan="2">-</td><td colspan="2">@</td><td>6@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Develop the ability of solving the Partial fraction, Binomial Series Exponential series and Logarithms Series
• Acquire knowledge about Matrices and Cayley – Hamilton Theorem.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">Unit-I Partial Fraction and Binomial Series
Partial Fraction-Resolution into partial fraction-Binomial theorem for a positive integral index- Binomial theorem for a rational index-Simple problems. Chapter-1 and 2</td></tr>
<tr><td colspan="8">Unit-II Exponential Series and Logarithms Series
Exponential series- Standard result for exponential series-Logarithms Series-Simple problems.
Chapter-3 and 4</td></tr>
<tr><td colspan="8">Unit-III Matrices
Introduction- Type of matrix-Matrix Operations-Transpose of a matrix-Determinant of a matrix-Inverse of a matrix-symmetric and skew symmetric-Conjugate of a matrix-Hermitian and skew Hermitian matrix-Simple problems
Chapter-5 (Page No:5.1 to 5.17)</td></tr>
<tr><td colspan="8">Unit-IV Rank of a Matrix
Orthogonal and Unitary matrix – Rank of a matrix- Test tor consistency of linear equation-Condition for consistency
Chapter-5 (Page No:5.18 to 5.49)</td></tr>
<tr><td colspan="8">Unit-V Cayley Hamilton Theorem
Definition of Characteristic equation of a matrix –Characteristic roots of a matrix - Eigen values and the Corresponding Eigen vectors of matrix– Cayley Hamilton theorem (Statement only) – Verifications of Cayley Hamilton Theorem – Problems only.
(Chapter 5) (Page No:5.50- 5.74)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">1. Dr.P.R. Vittal, Allied Mathematics ,Margham publication, Chennai– 17, Reprint 2016.</td></tr>
</table>

Reference Books	1. S.G Venkatachalapathi, Allied Mathematics, Margham publication, Chennai – 17, Reprint 2011 2. P. Kandasamy, K.Thilagavathy Allied Mathematics Volume I, S.Chand publication, July2012. 3. P. Kandasamy, K.Thilagavathy Allied Mathematics Volume II, S. Chand publication, December 2010.
Website and e-Learning Source	https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement
CO1	Define Partial Fraction and Binomial Series and examples
CO2	Define Exponential Series and Logarithms Series and examples
CO3	Define matrix and simple problems
CO4	Define Rank of matrix and problems
CO5	Describe Cayley Hamiltan Theorem

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	3	2	3
CO5	2	3	3	3	3

@ Refer to Curriculum Page No – 16 .

<table>
<tr><td>Title of the Course</td><td colspan="6">GRAPH THEORY AND ITS APPLICATION
(FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td>Paper Number</td><td colspan="6">ELECTIVE COURSE GENERIC SPECIFIC – EGS06</td></tr>
<tr><td rowspan="2">Category ELECTIVE</td><td>Year</td><td>I/II</td><td>Credits</td><td>5@</td><td>Course Code</td><td>23UMAEGS06</td></tr>
<tr><td>Semester</td><td>@</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">@</td><td>--</td><td>@</td><td colspan="2">6@</td></tr>
<tr><td>Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">• Graphs and subgraphs
• Walks, Trails and Paths
• Applications</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Introduction – Definition – Examples – Degrees – Definition – Theorem 1, 2 – Problems – Subgraphs – Definition – Theorems – Operations on graphs – Definition theorem-1 – Problems.
Chapter 2 (Sections 2.1 to 2.3, 2.9).</td></tr>
<tr><td colspan="6">UNIT-II: Introduction – Walks, Trails and Paths – Definitions Theorem – 1, 2, 3 – Connectedness and components – Definitions – Theorems – Definition – Distance – Theorems – Cut point – Bridge – Blocks – Connectivity.
Chapter 4 (Sections 4.1 to 4.4).</td></tr>
<tr><td colspan="6">UNIT-III: Introduction – Eulerian Graphs – Definition – Lemmas – Theorem – Konigsberg Bridge problem – Fleury‘s Algorithms – Hamiltonian graphs – Definitions – Theorems – Lemma – Closure – Theorems.
Chapter 5 (Sections 5.1, 5.2).</td></tr>
<tr><td colspan="6">UNIT – IV: Introduction – Characterization of Trees – Theorems – Centre of a tree – Definition – Theorem.
Chapter 6 (Sections 6.1, 6.2).</td></tr>
<tr><td colspan="6">UNIT-V: Introduction - Applications – Connector problem – shortest path problem – Transformation and kinematic Graph.
Chapter 11 (Sections 11.1 to 11.3)</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

Recommended Text	1. S. Arumugam, S. Ramachandran, Invitation to graph theory, Scitech Publications, Chennai, 2001.
Reference Books	2. John clark and Derek Allan Holton, A first book at graph theory, Allied publishes. 3. S. Kumaravelu and SusheelaKumaravelu, Graph theory, Publishers Authors C/O.182, Childambara Nagar, Nagarkoil – 629 002.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will able to

CLO 1: Define Graphs, Subgraphs and Operation on Graphs.

CLO 2: Define Walk, Trails and Paths.

CLO 3: Define Eulerian Graphs and Hamiltonian graphs. Explain the concept of Konigsberg Bridge problem and Fleury‘s Algorithms.

CLO 4: Explain Characterization of Trees and Theorems.

CLO 5: Explain Applications of Connector problem and shortest path problem.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	2	1	1	3	3	2
CLO2	3	2	3	2	1	1	3	3	2
CLO3	3	2	3	2	1	1	3	3	2
CLO4	3	2	3	2	1	1	3	3	2
CLO5	3	2	3	2	1	1	3	3	2

@ Refer to Curriculum Page No – 16 .

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">NUMERICAL METHODS-I
(FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE COURSE GENERIC SPECIFIC – EGS07</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">5@</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UMAEGS07</td></tr>
<tr><td>Semester</td><td>@</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">@</td><td colspan="2">-</td><td colspan="2">@</td><td>6@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12Th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Numerical methods is a mathematical tool designed to solve
• numerical problems.
• It is the study of numerical methods that attempt at finding.
• approximate solutions of problems rather than the exact ones.
• Apply Numerical differentiation and Numerical integration.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: The Bisection Method - The Iteration method - The method of false position - Newton Raphson Method
(Chapter 2: Sections 2.1 to 2.5)</td></tr>
<tr><td colspan="8">UNIT-II: Generalized Newton's Method - Ramanujan's Method-The Secant Method - Muller's Method-Graeffe‘s Root squaring Method
(Chapter 2: Sections 2.6 to 2.9))</td></tr>
<tr><td colspan="8">UNIT-III: Finite Difference - Forward Differences -Backward Differences - Central Differences - symbolic relations and separation of symbols-Detection of Errors by Use of Difference Tables.
(Chapter 3: Sections 3.3(3.3.1 - 3.3.4),3.4</td></tr>
<tr><td colspan="8">UNIT-IV: Differences of Polynomial- Newton's formulae for interpolation – Central Differences interpolation formulae - Gauss Central difference formulae - Stirling Formulae - Bessel's Formulae -Everett's formulae (Problems only).
(Chapter 3: Sections 3.5,3.6.3.7(3.7.1 - 3.7.4))</td></tr>
<tr><td colspan="8">UNIT-V: Lagrange's Interpolation Formulae – Divided differences - Divided differences table - Newton's Divided Difference formulae - Inverse Interpolation. (Problems only)
(Chapter 3: Sections 3.9.1, 3.11.1, 3.12)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability.
Recommended Text	1. S.S. Sastry - Introductory methods of numerical Analysis 3rd Edition, Prentice Hall of India Private Ltd., New Delhi.
Reference Books	1. P. Kandasamy, K. Thilagavathy, K. Gunavathy - Numerical Methods, Third Revised Edition, S.Chand& Companyy Ltd., Ram Nagar, New Delhi.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement
CO1	Define Algebraic methods and problems
CO2	Define Newtons methods and Root squaring methods and problems
CO3	Define finite differences and problems
CO4	Define Interpolation methods and problems
CO5	Define divided differences and inverse interpolation and problems

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	3	2	3
CO5	2	3	3	3	3

@ Refer to Curriculum Page No – 16 .

Title of the Course	**NUMERICAL METHODS-II**

<table>
<tr><td colspan="2"></td><td colspan="8">(FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE COURSE GENERIC SPECIFIC – EGS08</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">5@</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UMAEGS08</td></tr>
<tr><td>Semester</td><td>@</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">@</td><td colspan="2">-</td><td colspan="2">@</td><td>6@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Numerical methods is a mathematical tool designed to solve
• numerical problems.
• It is the study of numerical methods that attempt at finding.
• approximate solutions of problems rather than the exact ones.
• Apply Numerical differentiation and Numerical integration.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Introduction- Numerical Differentiation - Maximum and minimum values of Tabulated function.
(Chapter 5: Sections 5.1, 5.2,5.3)</td></tr>
<tr><td colspan="8">UNIT-II: Numerical Integration-Trapezoidal Rule - Simphson 1/3 Rule - Simphson 3/8 Rule -Boole's and Weddle's rule. (Problems only)
(Chapter 5: Sections 5.4(5.4.1 - 5.4.4))</td></tr>
<tr><td colspan="8">UNIT-III: Direct method –Matrix Inversion Method-Gauss elimination Method – Gauss Jordan Method - Modification of Gauss Method to compute the inverse -Number of Arithmetic Operations-LU Decomposition-LU Decomposition from Gauss Elimination
(Chapter 6: Sections 6.3(6.3.1 - 6.3.7))</td></tr>
<tr><td colspan="8">UNIT-IV: Method of Factorization - Iterative Methods -Gauss Jacobi method - Gauss seidel Method. (Problems only)
(Chapter 6: Sections 6.4)</td></tr>
<tr><td colspan="8">UNIT-V: Solution by Taylor‘s Series-Picard‘s Method of Successive Approximations-Eluler‘s Method-Runge-Kutta Method.
(Chapter 7: Sections 7.2 to 7.5)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability.
Recommended Text	1. S.S. Sastry - Introductory methods of numerical Analysis 3rd Edition, Prentice Hall of India Private Ltd., New Delhi.
Reference Books	1. P. Kandasamy, K. Thilagavathy, K. Gunavathy - Numerical Methods, Third Revised Edition, S.Chand& Company Ltd., Ram Nagar, New Delhi.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement
CO1	Define Numerical differentiation and problems
CO2	Define Numerical Integration and problems
CO3	Define direct methods and number of arithmetic operations related problems
CO4	Define Method of factorization and problems
CO5	Define solution by Taylor's Series and problems

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	3	2	3
CO5	2	3	3	3	3

@ Refer to Curriculum Page No – 16.

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DISCRETE MATHEMATICS – PRACTICAL
(FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE COURSE GENERIC SPECIFIC – EGSP01</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UMAEGSP01</td></tr>
<tr><td>Semester</td><td>II/IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td colspan="2">-</td><td>2@</td><td>2@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Acquire knowledge about Negation and Conjunction
• Understand the concepts of Characteristic equation and Characteristic roots</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I:
Negation – Conjunction – Disjunction – Tautologies.</td></tr>
<tr><td colspan="6">UNIT-II:
Conditional – Biconditional.</td></tr>
<tr><td colspan="6">UNIT-III:
Boolean Algebra – Boolean functions.</td></tr>
<tr><td colspan="6">UNIT-IV:
Characteristic equation of Matrix – Characteristic roots.</td></tr>
<tr><td colspan="6">UNIT-V:
Cayley Hamilton Theorem – Rank of Matrix</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Discrete Mathematics Structures with application to computer science – J.P. Tremblay and R. Manohar.
2. Discrete Mathematics – B.S. Vatssa, Suchi Vatssa.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1. Discrete Mathematics – Dr.S.P.Rajagopalan and Dr.R.Sattanathan
2. Discrete Mathematics – Dr.G.Balaji
3. Discrete Mathematics and its applications – Kenneth.H.Rosen</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">NUMERICAL METHODS – PRACTICAL
(For All Computer Science Department)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE COURSE GENERIC SPECIFIC – EGSP02</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UMAEGSP02</td></tr>
<tr><td>Semester</td><td>II/IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td colspan="2">-</td><td>2@</td><td>2@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12Th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• Acquire knowledge about Bisection Method and Iteration Method.
• Understand the concepts of Gauss Jacobi Method and Gauss Seidel Method.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT-I:
The Bisection Method – The Iteration Method.</td></tr>
<tr><td colspan="7">UNIT-II:
Newton‘s Interpolation Formula for Forward and Backeard difference.</td></tr>
<tr><td colspan="7">UNIT-III:
Lagrange‘s Interpolation Formula.</td></tr>
<tr><td colspan="7">UNIT-IV:
Gauss elimination Method – Gauss Jordan Method.</td></tr>
<tr><td colspan="7">UNIT-V:
Gauss Jocobi Method – Gauss seidel Method.</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="7">Knowledge, Problem Solving, Analytical ability.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="7">1. S.S. Sastry – Introductory Methods of numerical Analysis 3rd Edition, Prentice Hall of India Private Ltd., New Delhi.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="7">1. P. Kandasamy, K. Thilagavathy, K. Gunavathy – Numerical Methods, Third Revised Edition, S. Chand & Company Ltd., Ram Nagar, New Delhi.</td></tr>
<tr><td colspan="9">@ Refer to Curriculum Page No – 16 .</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">OPTIMIZATION TECHNIQUES – PRACTICAL
(FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE COURSE GENERIC SPECIFIC – EGSP03</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UMAEGSP03</td></tr>
<tr><td>Semester</td><td>II/IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="3">Lecture</td><td>Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="3">-</td><td>-</td><td>2@</td><td>2@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12Th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• Acquire knowledge about LPP and Graphical Method.
• Understand the concepts of Rules for constructing a project network.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT-I:
Linear Programming Problem – Graphical Method.</td></tr>
<tr><td colspan="7">UNIT-II:
Transportation Problem – Finding initial basic feasible solution only by using North-West Corner Rule, Least Cost Method – Vogel‘s Approximation Method.</td></tr>
<tr><td colspan="7">UNIT-III:
Assignment Problem – Finding optimal solution by using Hungarian Method.</td></tr>
<tr><td colspan="7">UNIT-IV:
Sequencing Problem – N jobs to be operated on Two Machines.</td></tr>
<tr><td colspan="7">UNIT-V:
Network - Rules for constructing a project network – Floats.</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="7">Knowledge, Problem Solving, Analytical ability.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="7">1. Sundaresan. V., Ganapathy Subramanian K.S. and Ganesan. K, Resource Management Techniques. [Seventh Edition]. AR Publication, Chennai.2013.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="7">1. Kantiswarup., Gupta, P.K. and Man Mohan. Operations Research [Seventeenth Edition]. Sultan Chand and Sons, New Delhi.2020.
2. Gupta, P.K. and Hira,D.S. Operations Research [Eighth Edition]. Sultan Chand and Sons, New Delhi.2020.
3. Kalavathy.S. Operations Research [Fourth Edition], vikas publishing House, Chennai.2012.</td></tr>
<tr><td colspan="9">@ Refer to Curriculum Page No – 16 .</td></tr>
</table>

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">INTRODUCTION TO LINEAR ALGEBRA – PRACTICAL (FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td colspan="2"></td><td colspan="6">ELECTIVE COURSE GENERIC SPECIFIC – EGSP04</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td>Course Code</td><td>23UMAEGSP04</td></tr>
<tr><td>Semester</td><td>II/IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td colspan="2">-</td><td>2@</td><td>2@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12Th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Acquire knowledge about Matrices and Caley-Hamilton Theorem.
• Understand the concepts of Symmetric and Skew Symmetric.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I:
Definitions of matrices – Addition, Subtraction and Multiplication of Matrices – Problems only.</td></tr>
<tr><td colspan="6">UNIT-II:
Transpose of a Matrix – Adjoint of a Matrix – Inverse of a matrix – Problems only.</td></tr>
<tr><td colspan="6">UNIT-III:
Definitions of Symmetric, Skew Symmetric, Hermitian and Skew Hermitian matrices – Problems only.</td></tr>
<tr><td colspan="6">UNIT-IV:
Rank of a Matrix: Definition – Finding the rank of Matrix – Problem upto 3 X 3 Matrix only.</td></tr>
<tr><td colspan="6">UNIT-V:
Characteristic equation of Matrix – Cayley Hamilton Theorem – Verification of Caley Hamilton Theorem – Simple Problems only.</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Dr.P.R. Vittal, Allied Mathematics, Margham Publication, Chennai – 17, Reprint 2012.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1. S.G.Venkatachalapathi, Allied Mathematics, Margham Publication, Chennai – 17, Reprint 2011.</td></tr>
<tr><td colspan="8">@ Refer to Curriculum Page No – 16 .</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">GRAPH THEORY AND ITS APPLICATION -PRACTICAL (FOR ALL COMPUTER SCIENCE DEPARTMENTS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE COURSE GENERIC SPECIFIC – EGSP05</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">23UMAEGSP05</td></tr>
<tr><td>Semester</td><td>II/IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">2@</td><td>2@</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12Th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• Acquire knowledge about Graphs and Subgraphs.
• Understand the concepts of Walks, Trails and Paths.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT-I:
Graphs – Subgraphs – Operations on Graphs.</td></tr>
<tr><td colspan="7">UNIT-II:
Connected Graphs – Disconnected Graphs and Components.</td></tr>
<tr><td colspan="7">UNIT-III:
Walks, Trails and Paths.</td></tr>
<tr><td colspan="7">UNIT-IV:
Eulerian Graphs – Hamiltonian Graphs.</td></tr>
<tr><td colspan="7">UNIT-V:
Trees – Characterization of Trees – Centre of a Tree.</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="7">Knowledge, Problem Solving, Analytical ability.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="7">1. S.Arumugam, S. Ramachandran, Invitation to graph theory, Scitech Publications, Chennai, 2001.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="7">1. John clark and Derek Allan Hoton, A first book at graph theory, Allied publishes.
2. Harray, Graph Theory, Narosa Publications, New Delhi.</td></tr>
<tr><td colspan="9">@ Refer to Curriculum Page No – 16 .</td></tr>
</table>

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">NUMERICAL METHODS WITH APPLICATIONS
(FOR B. Sc MATHEMATICS WITH COMPUTER APPLICATIONS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE COURSE DISCIPLINE-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UMAECD01</td></tr>
<tr><td>Semester</td><td>III</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
--</td><td>Lab Practice
--</td><td>Total
4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Interpolate an unknown value from a given set of data.
• Compute numerical solutions of algebraic and transcendental equations.
• Compute numerical solutions of integration problems and ODE.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT-I: INTERPOLATION

Newton‘s Forward and Backward formulae for Interpolation- Central difference formulae- Gauss Forward, Gauss Backward, Stirling‘s and Bessel‘s formulae- Simple Problems only. (Derivations of Formulae and Proof of theorems are excluded)

(Chapter 6: Section 6, Chapter 7: Section 7 to 7.6)</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II: INTERPOLATION WITH UNEQUAL INTERVALS

Lagrange‘s Formula for Interpolation – Newton‘s Divided Differences formula. Lagrange‘s inverse interpolation -Simple Problems only. (Derivations of Formulae and Proof of theorems are excluded)

(Chapter 6: Section 8.5 to 8.8)</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-III : SOLUTION OF ALGEBRAIC AND TRANSCEDENTAL EQUATIONS

Numerical solutions of polynomial and Transcendental equations in one variable. Bi-Section Method –Method of false position (Regular Falsi Method) - Method of Iteration - Newton Raphson Method (Derivations of the formulae are excluded)

(Chapter 3: Section 3.1 to 3.4)</td></tr>
</table>

	UNIT-IV: **NUMERICAL INTEGRATION** Quadrature Formula for equidistant ordinates based on Newton's Forward formula – Trapezoidal rule – Simpson's one third rule – Simpson's Three Eighth rule - Simple Problems only.(Derivations of Formulae are excluded) (Chapter 9: Section 9.7 to 9.9, 9.13, 9.14)
	UNIT-V: Numerical solution of ordinary differential equation (first order only), Euler's method - Modified Euler's method- Picard's method of successive approximation.-Runge-Kutta method fourth order only (Chapter 11: Section 11, 11.8, 11.9, 11.11, 11.12)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1.P. Kandasamy & K. Thilagavathy, K.Gunavathi, *Numerical Methods*, S. Chand & Co.

Reference Books	1. B.D. Gupta (2001) Numerical Analysis Konark publications Ltd., Delhi 2. Dr. M.K. Venkataraman, Numerical Methods in Science & Engineering, Fifth edition (1999), The National Publishing Company, Chennai. 3. H.C. Saxena (1991) Finite difference and numerical analysis S.Chand & Co. Delhi. 4. S.Arumugham(2003) Numerical Methods, New Gamma Publishing, Palayamkottai. 5. M.K.Jain, S.R.K.Iyengar, R.K.Jain, Numerical methods for scientific and engineering computation, Sixth edition(2012), New age International Publishers, New Delhi. 6. E.Balagurusamy, Numerical Methods (1999),Tata Mc.Graw Hill, New Delhi. 7. T.K.Manicavachagam Pillai & Prof. S. Narayanan, Numerical Analysis, New Edition (2001), S. Viswanathan Printers & publishers Pvt Ltd, Chennai.
Website and e-Learning Source	https://nptel.ac.in

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total
25	**75**	**100**

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Applying the Methods of interpolation to compute the missing value in real life problems.

CLO 2: Compute the missing values for unequal intervals using Divided differences and Lagrange Method

CLO 3: Apply Numerical Methods to evaluate numerical solution of algebraic and transcendental equations..

CLO 4: Compute definite integral for different combinations of integrands using various methods and analyze their accuracy.

CLO 5: Evaluate the solution of first order differential equation using Euler, Picard's and Runge - Kutta Methods.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	2	1	2	1	3	2	1
CLO2	3	3	2	1	2	-	3	2	1
CLO3	3	3	2	1	2	1	3	2	1
CLO4	3	3	3	2	2	-	3	2	1
CLO5	3	3	3	2	2	1	3	2	1

3 - Strong Correlation 2 - Medium Correlation 1 - Low Correlation

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICAL STATISTICS
(FOR B. Sc MATHEMATICS WITH COMPUTER APPLICATIONS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE COURSE DISCIPLINE-II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMAECD02</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2"></td><td>3</td><td>--</td><td>--</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. Acquire the knowledge about Theoretical Distributions and understand the concepts of correlation and regression.
2. Be familiarized with the applications of various test of significance</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="6">Unit I: Theoretical Distributions : Binomial – Poisson – Normal distributions - Fitting of distributions - Simple Problems (Derivations excluded) (Chapter 8: Sec 8.4,8.5, Chapter 9: Sec 9.2)</td></tr>
<tr><td colspan="6">Unit II:. Correlation and Regression : Karl Pearson‘s Coefficient of Correlation-Rank Correlation – Lines of Regressions - Simple Problems (Derivations excluded) (Chapter 10: Sec 10.4 to 10.7, Chapter 11: Sec 11.2 to 11.4)</td></tr>
<tr><td colspan="6">Unit III: Test of Significance For Large Samples: Z-test- Test for Single Proportion- Test of Significance for Difference of Proportions -Test of Significance for Single Mean- Test of Significance for Difference of Means- Simple Problems (Derivations excluded)(Chapter 14: Sec 14.6 to 14.8 , Chapter 16 : Sec 16.11)</td></tr>
<tr><td colspan="6">Unit IV: Test of Significance For Small Samples: t- Test –Test for Single Mean-Test for Difference Of Means- Paired t-Test For Difference of Means - F- Test for Equality of Population Variance- Simple Problems (Derivations excluded) (Chapter 16: Sec 16.2 to 16.10)</td></tr>
</table>

	Unit V: Chi-Square Test- Test of Goodness of Fit, Test for Independence of Attributes. Analysis Of Variance: ANOVA – One Way Classification, Two Way Classification. Simple Problems (Derivations excluded) (Chapter 15: Sec 15.1 to 15.7)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1.S.C. Gupta and V.K. Kapoor, Elements of Mathematical Statistics, Third edition(2015) Sultan Chand & Sons publications, New Delhi.
Reference Books	1. P.R. Vittal, Mathematical Statistics(2002), Margham Publications,Chennai. 2. S.C. Gupta and V.K. Kapoor,Fundamentalsof Mathematical Statistics, Eleventh edition(2002)Sultan Chand & Sons publications 3. RobertV.Hogg,Joseph Mckean &Craig A.T,Introduction to Mathematical Statistics,(2013)PearsonsEducation India 4. George W.Snedecor, William G.Cochran ,Statistical Methods(1967),Oxford &IBH Publishers 5. Dr.S.P.Gupta, Statistical Methods,41st edition (2011),Sultan Chand &Sons,NewDelhi.
Website and e-Learning Source	**https://nptel.ac.in**

METHOD OF EVALUATION

Continuous Internal Assessment	End Semester Examination	Total
25	**75**	**100**

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Apply binomial, Poisson and normal distribution properties to solve real life problems.

CLO 2: Study the relationship between two or more variables.

CLO 3: Understand the uses of Large Samples.

CLO 4: Apply the concept of small sample test to solve real life problems.

CLO 5: Apply and examine chi-square test and analyse the principles of designs of experiments to yield valid conclusions.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	3	3	1	2	3	3	1
CLO2	3	3	3	3	1	2	3	3	1
CLO3	3	3	3	3	1	2	3	3	1
CLO4	3	3	3	3	1	2	3	3	1
CLO5	3	3	3	3	1	2	3	3	1

3- Strong Correlation 2-Medium Correlation 1- Low Correlation